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THE MEASUREMENT OF EFFICIENCY IN READING.

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Introduction.—The current movement for measuring school products is one of the three or four most important fields of investigation in the scientific study of educational problems. Very material progress has been made during the last five years in the endeavor to devise accurate methods for measuring the actual efficiency of pupils in school studies. The first substantial contributions[1] were made by Thorndike in his scale for measuring handwriting and by Courtis in his tests for measuring arithmetical abilty. These have been followed by Hillegas' scale for English composition, by Ayres' scale for handwriting, by Thorndike's scale for drawing, and by Buckingham's study of spelling ability. Methods for measuring achievement in other studies are under way, so that we now have fairly accurate tests and scales for measuring efficiency in most of the fundamental elementary school studies and in two or three high-school subjects.

[1]E. L. THORNDIKE. *Handwriting.* 1910. Columbia University.
S. A. COURTIS. *Report on Educational Aspects of the Public School System of the City of New York.*
M. B. HILLEGAS. *A Scale for the Measurement of Quality in English Composition by Young People.* 1913.
L. P. AYRES. *A Scale for Measuring the Quality of Handwriting of School Children.* Russell Sage Foundation, New York.
E. L. THORNDIKE. *The Measurement of Achievement in Drawing.* 1913.
B. R. BUCKINGHAM. *Spelling Ability.* Columbia University.

It is unnecessary to point out the scientific and practical value of such investigations for all who are connected with the schools—administrators, supervisors, teachers, pupils and students of educational problems. These tests will furnish the tools for evaluating quantitatively the results of methods and factors in teaching and learning, and for examining various aspects of efficiency of instruction and administration of school systems.

Essential Elements in Reading.—Adequate measurements of any complex mental functions, such as those involved in school studies, require first of all an analysis of the functions into their essential constituents, and, second, the preparation of accurate tests for each of these elements. From the practical point of view, we learn to read in order to obtain information. Obviously, then, the chief elements in reading are (1) the comprehension of the material read, (2) the speed of reading, and (3) the correctness of the pronunciation. The first two are the most important so far as reading strictly is concerned, since we learn to read for our own individual use. For this reason, such factors as intonation, expression, pauses and the like are relatively insignificant. We use silent rather than oral reading in practical life.

Methods of Testing.—The speed of reading may be measured rather easily by determining the amount of a certain kind of text that can be read in a given period of time, for example, the number of words read per minute, or preferably per second. Comprehension perhaps cannot be determined quite so easily. ~~In the tests~~ to be described presently the method adopted consists in reproducing the thought in writing immediately after the ~~reading~~.

The tests as finally developed will be described first and the various critical points concerning their technique and reliability will be considered later.

A very important matter to take into account in testing the reading capacity of children is the extent of their vocabularly and the range of their ideas. It therefore became necessary to select a graded series of passages as test material. Eight passages (see following pages) were chosen from various graded readers, one for each of the eight grades. The pas-

sages were so selected that the increase in difficulty from one sample to the next would represent fairly uniform steps. This selection was guided largely by the differences between the readers used in the different grades. Thus selection 1 was chosen from a typical first reader, selection 2 from a second reader, etc. Since we do not know the actual difficulty of these passages, and since it is rather important to measure the increase of reading capacity from grade to grade, each grade was tested with the passage designed for it and also with the passage designed for the grade next below it. Thus the fourth-grade pupils were tested with selection 4 on one day and with selection 3 on the next day. The third grade was tested with selections 3 and 2, etc. In this manner a direct comparison of each grade with the grade below it or above it can be made on the basis of the same test material.

No. 1.[2]

Once there was a little girl who lived with her mother.
They were very poor.
Sometimes they had no supper.
Then they went to bed hungry.
One day the little girl went into the woods.
She wanted sticks for the fire.
She was so hungery and sad!
"Oh, I wish I had some sweet porridge!" she said.
"I wish I had a pot full for mother and me.
We could eat it all up."
Just then she saw an old woman with a little black pot.
She said, "Little girl, why are you so sad?"
"I am hungry," said the little girl.

No. 2.

Betty lived in the South, long, long ago. She was only ten years old, but she liked to help her mother.

She had learned to do many things. She could knit and sew and spin; but best of all she liked to cook.

One day Betty was alone at home because her father and mother and brother had gone to town to see a wonderful sight.

The great George Washington was visiting the South. He was going from town to town, riding in a great white coach trimmed with shining gold. It had leather curtains, and soft cushions. Four milk-white horses drew it along the road.

Four horsemen rode ahead of the coach to clear the way and four others rode behind it. They were all dressed in white and gold.

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[2]Selections 1 and 2 were printed in 14-point, 3 and 4 in 12-point, and the rest in 10-point type. The special blanks for making the reading tests may be obtained from the author, who will be glad to co-operate with teachers or superintendents of schools who may desire to make the tests.

No. 3.

Little Abe hurried home as fast as his feet could carry him. Perhaps if he had worn stockings and shoes like yours, he could have run faster. But, instead, he wore deerskin leggings and clumsy moccasins of bear skin that his mother had made for him.

Such a funny little figure as he was, hurrying along across the rough fields! His suit was made of war homespun cloth. His cap was made of coonskin, and the tail of the coon hung behind him, like a furry tassel.

But if you could have looked into the honest, twinkling blue eyes of this little lad of long ago, you would have liked him at once.

In one hand little Abe held something very precious. It was only a book, but little Abe thought more of that book than he would have thought of gold or precious stones.

You cannot know just what that book meant to little Abe, unless you are very fond of reading. Think how it would be to see no books except two or three old ones that you had read over and over until you knew them by heart!

No. 4.

The red squirrel usually waked me in the dawn, coursing over the roof and up and down the sides of the house, as if sent out of the woods for this very purpose.

In the course of the winter I threw out half a bushel of ears of sweet-corn on to the snow crust by my door, and was amused by watching the motions of the various animals which were baited by it. All day long the red squirrels came and went, and afforded me much entertainment by their maneuvers.

One would approach, at first, warily through the shrub-oaks, running over the snow crusts by fits and starts like a leaf blown by the wind. Now he would go a few paces this way, with wonderful speed, making haste with his "trotters" as if it were a wager; and now as many paces that way, but never getting on more than half a rod at a time.

Then suddenly he would pause with a ludicrous expression and a somerset, as if all eyes in the universe were fixed on him. Then, before you could say Jack Robinson, he would be in the top of a young pitch-pine, winding up his clock and talking to all the universe at the same time.

No. 5.

Once upon a time, there lived a very rich man, and a king besides, whose name was Midas; and he had a little daughter, whom nobody but myself ever heard of, and whose name I either never know, or have entirely forgotten. So, because I love odd names for little girls, I choose to call her Marygold.

This King Midas was fonder of gold than anything else in the world. He valued his royal crown chiefly because it was composed of that precious metal. If he loved anything better, or half so well, it was the one little maiden who played so merrily around her father's footstool. But the more Midas loved his daughter, the more did he desire and seek for wealth. He thought, foolish man! that the best thing he could possibly do for his dear child would be to give her the immensest pile of yellow, glistening coin, that had ever been heaped together since the world was made. Thus, he gave all his thoughts and all his time to this one purpose. If ever he happened to gaze for an instant at the goldtinted clouds of sunset, he wished that they were real gold, and that they could be squeezed safely into his strong box. When little Marygold ran to meet him, with a bunch of buttercups and dandelions, he used to say, "Poh, poh, child! If these flowers were as golden as they look, they would be worth the plucking!"

And yet, in his earlier days, before he was so entirely possessed of this insane desire for riches, King Midas had shown a great taste for flowers.

No. 6.

In a secluded and mountainous part of Stiria there was in old times a valley of the most surprising and luxuriant fertility. It was surrounded on all sides by steep and rocky mountains, rising into peaks which were always covered with snow, and from which a number of torrents descended in constant cataracts. One of these fell westward over the face of a crag so high that, when the sun had set to everything else, and all below was darkness, his beams still shone full upon this waterfall, so that it looked like a shower of gold. It was, therefore, called by the people of the neighborhood, the Golden River. It was strange that none of these streams fell into the valley itself. They all descended on the other side of the mountains, and wound away through broad plains and past populous cities. But the clouds were drawn so constantly to the snowy hills, and rested so softly in the circular hollow, that in time of drought and heat, when all the country round was burnt up, there was still rain in the little valley; and its crops were so heavy and its hay so high, and its apples so red, and its grapes so blue, and its wine so rich, and its honey so sweet, that it was a marvel to everyone who beheld it, and was commonly called the Treasure Valley.

The whole of this little valley belonged to three brothers called Schwartz, Hans and Gluck. Schwartz and Hans, the two elder brothers, were very ugly men, with overhanging eyebrows and small dull eyes.

No. 7.

Captain John Hull was the mint-master of Massachusetts, and coined all the money that was made there. This was a new line of business, for in the earlier days of the colony the current coinage consisted of gold and silver money of England, Portugal, and Spain. These coins being scarce, the people were often forced to barter their commodities instead of selling them.

For instance, if a man wanted to buy a coat, he perhaps exchanged a bear-skin for it. If he wished for a barrel of molasses, he might purchase it with a pile of pine boards. Musket-bullets were used instead of farthings. The Indians had a sort of money called wampum, which was made of clam-shells, and this strange sort of specie was likewise taken in payment of debts by the English settlers. Bank-bills had never been heard of. There was not money enough of any kind, in many parts of the country, to pay the salaries of the ministers, so that they sometimes had to take quintals of fish, bushels of corn, or cords of wood instead of silver or gold.

As the people grew more numerous and their trade one with another increased, the want of current money was still more sensibly felt. To supply the demand the general court passed a law for establishing a coinage of shillings, sixpences, and threepences. Captain John Hull was appointed to manufacture this money, and was to have about one shilling out of every twenty to pay him for the trouble of making them.

No. 8.

The years went on, and Ernest ceased to be a boy. He had grown to be a young man now. He attracted little notice from the other inhabitants of the valley; for they saw nothing remarkable in his way of life, save that, when the labor of the day was over, he still loved to go apart and gaze and meditate upon the Great Stone Face. According to their idea of the matter, it was a folly, indeed, but pardonable, inasmuch as Ernest was industrious, kind, and neighborly, and neglected no duty for the sake of indulging this idle habit. They knew not that the Great Stone Face had become a teacher to him, and that the sentiment which was expressed in it would enlarge the young man's heart, and fill it with wider and deeper sympathies than other hearts. They knew not that thence would come a better wisdom than could be learned from books, and a better life than could be moulded on the defaced example of other human lives. Neither did Ernest know that the thoughts and affections which

came to him so naturally, in the fields and at the fireside, and wherever he communed with himself, were of a higher tone than those which all men shared with him.

By this time poor Mr. Gathergold was dead and buried; and the oddest part of the matter was, that his wealth, which was the body and spirit of his existence, had disappeared before his death, leaving nothing of him but a living skeleton, covered over with a wrinkled, yellow skin. Since the melting away of his gold, it had been very generally conceded that there was no such striking resemblance, after all, betwixt the ignoble features of the ruined merchant and that majestic face upon the mountainside.

No. 9.

To an American visiting Europe, the long voyage he has to make is an excellent preparative. The temporary absence of worldly scenes and employments produces a state of mind peculiarly fitted to receive new and vivid impressions. The vast space of waters that separates the hemispheres is like a blank page in existence. There is no gradual transition, by which, as in Europe, the features and population of one country blend almost imperceptibly with those of another. From the moment you lose sight of the land you have left, all is vacancy until you step on the opposite shore, and are launched at once into the bustle and novelties of another world.

In traveling by land there is a continuity of scene and a connected succession of persons and incidents, that carry on the story of life, and lessen the effect of absence and separation. We drag, it is true, "a lengthening chain," at each remove of our pilgrimage; but the chain is unbroken: we can trace it back link by link; and we feel that the last still grapples us to home. But a wide sea voyage severs us at once. It makes us conscious of being cast loose from the secure anchorage of settled life, and sent adrift upon a doubtful world. It intersposes a gulf, not merely imaginary, but real, between us and our homes—a gulf subject to tempest, and fear, and uncertainty, rendering distance palpable, and return precarious.

The directions for administering the tests were as follows:

Explain to the pupils that they are to read silently as rapidly as they can and at the same time to grasp as much as they can, and that they will be asked to write down, not necessarily in the same words, as much as they will remember of what they read.

They should also be told not to read anything over again, but to read on continuously as rapidly as is consistent with grasping what they read.

Use for a given grade the test blank that bears the same number as your grade. For example, use number 4 with the fourth grade, number 5 with the fifth grade, etc. On the next day repeat the test in the same manner, but use the blank of the grade next below yours, that is, in the fourth grade use number 3, in the fifth grade use number 4, etc.

The blanks for the test should be distributed to the pupils *with the backs of the blanks up*, so that no one will be able to read any of the material until all are ready. Then give the signal "turn" and "start." Allow them to read *exactly thirty seconds*. Then have the pupils make a mark with pencil after the last word read to indicate how far they had read.

Then have them turn the blanks over immediately and write on the back all that they remember having read. Allow as much time as they need, but make sure that they do not copy from each other, or turn the blank over to see the text. Finally, have them fill out the spaces at the bottom of the blank.

N. B.—Make sure of allowing exactly 30 seconds for the reading. See that they all start and stop at the same time.

The pronunciation could be tested by having the pupil read the passage aloud after the test for speed and comprehension

have been completed, and by noting the number of words pronounced incorrectly. This test would have to be made individually and out of reach of hearing of the rest of the pupils.

Scoring of the Results.—The speed of reading is determined by ascertaining the number of words read per second. This can be done very rapidly by having a blank on which is indicated the number of words to the end of each line. By this blank the total number of words read can be determined almost instantaneously. Dividing by thirty will give the speed of reading per second.

The comprehension is determined by counting the number of words written which correctly reproduce the thought. The written account is carefully read, and all words which either reproduce the ideas of the test passage incorrectly or add ideas not in the test passage or repeat ideas previously recorded are crossed out. The remaining words are counted and used as the index of comprehension. Various objections may be urged against this method of scoring, but these are believed not to be serious. They will be considered below.

A sample test follows to illustrate the method of scoring. It is the test of an eighth-grade girl with test No. 8. This pupil had read 142 words, or 3.7 words per second. She wrote 77 words, five of which were discarded. These are enclosed in parentheses in the following:

The years went on and Earnest grew to be a man. He was not so very well known in the valley as he was quiet (with know habits besides always) at night when his work was done, he went aside and watched the Great Stone Face. As he was industrious and kind and only indulged in this idle amusement the neighbors thought it all right. They did not know that the Great Stone Face became a teacher to him.

Critical Points Concerning the Reliability of the Tests.—First the time limit. Does reading for thirty seconds adequately test a person's reading capacity? The time limit of thirty seconds was chosen, first, because the necessary text for this interval could all be printed on a sheet of paper about the size of an ordinary page in a reader, and second, because a longer interval of time would increase very materially the labor of scoring the results. But irrespective of length of text or labor of scoring, the chief point is the reliability of the tests.

In order to determine whether thirty seconds is an adequate length of time, a test was made on seven persons (seniors and

graduates) with two longer passages, one requiring approximately two and one-half minutes to read and the other approximately five minutes. The shorter passage was "Home," by H. W. Grady, and the longer one was "A Palace in a Valley," by Dr. Samuel Johnson, both in Cyr's eighth reader, pages 135 and 139.

The results of this test, as set forth in the following table, show that the speed of reading is practically constant for all three passages:

		Selection No. 9.	Home.	Palace in a Valley.
1.	Speed (words per second)	6.1	6.1	6.9
	Comprehension (words written)	90	369	407
2.	Speed	7.1	5.3	7.2
	Comprehension	123	280	730
3.	Speed	3.8	3.4	5.3
	Comprehension	38	243	112
4.	Speed	5.1	3.6	3.2
	Comprehension	69	244	...
5.	Speed	7.1	6.5	6.5
	Comprehension	117	463	635
6.	Speed	4.3	7.4	6.9
	Comprehension	66	204	333
7.	Speed	3.9	4.3	...
	Comprehension	64	249	274
	Averages—Speed	5.4	5.1	6.0
	Comprehension	81	293	415

The average speed for all subjects in case of the thirty seconds test was 5.4 words per second, for the next longer passage 5.1 words per second, and for the longest passage 6.0 words per second. One or two of the subjects, for example, Nos. 3 and 6, read considerably more rapidly on some of the passages than on others, but this is usually offset by smaller retention. Hence so far as speed is concerned, the thirty-second interval is entirely adequate. As to comprehension, more is retained absolutely, but less relatively, from the longer selections. This, of course, was to be expected. In order to make a quantitative comparison, each person was given a rank for both speed and comprehension, as shown in the following table:

Subjects.	Selection No. 9.	Home.	Palace in a Valley.
1.	3	2	2
2.	1	3	1
3.	7	7	6
4.	4	6	7
5.	2	1	3
6.	5	4	4
7.	6	5	5

A person's performance in one passage is practically the same as in any other. Any person's rank is very nearly the same in all three passages. The coefficient of correlation between the tests with selection No. 9 and "Home" is .75; between "Home" and "Palace in a Valley" .82, and between No. 9 and "Palace in a Valley" .75.

These results indicate pretty definitely that the interval of thirty seconds is sufficiently long to give a very adequate test of a person's reading capacity both in regard to speed and comprehension of reading.

A second critical point is the increasing difficulty of the test passages. The eight selections were chosen from graded readers according to the best judgment. The problem, nevertheless, remains whether the successive selections increase by equal or nearly equal steps. This point is not especially important, since the growth in reading capacity from grade to grade can be measured by the method already described, namely, of testing each grade with its own sample and also with the sample of the grade just below it, and if desired, also with the sample of the grade just above it. However, it is interesting to ascertain the increase in difficulty, since uniformity is at least desirable, if not necessary. The data for this comparison are available from the tests already made. The speed and comprehension for all selections were computed from the tests of 1414 pupils and plotted in the curves in Fig. 1. An average curve, giving equal weight to speed and comprehension, is drawn between the two. The increases in either the speed or the comprehension are irregular in two or three places, but a rapid increase in one is, as a rule, counterbalanced by a smaller increase in the other. Thus selection No. 4 has a rapid gain in speed over No. 3, but no gain in comprehension. The same is true for No. 6. The resulting average is a smooth curve rising at a fairly uniform rate. This would indicate that the steps are fairly uniform in difficulty. In the original set of tests passages No. 9 was used in place of No. 8, but it was found to be relatively too difficult. The speed was 3.3 words per second and the comprehension 28 words on the average. This was less than the records for No. 7. The selection was then replaced by the present No. 8.

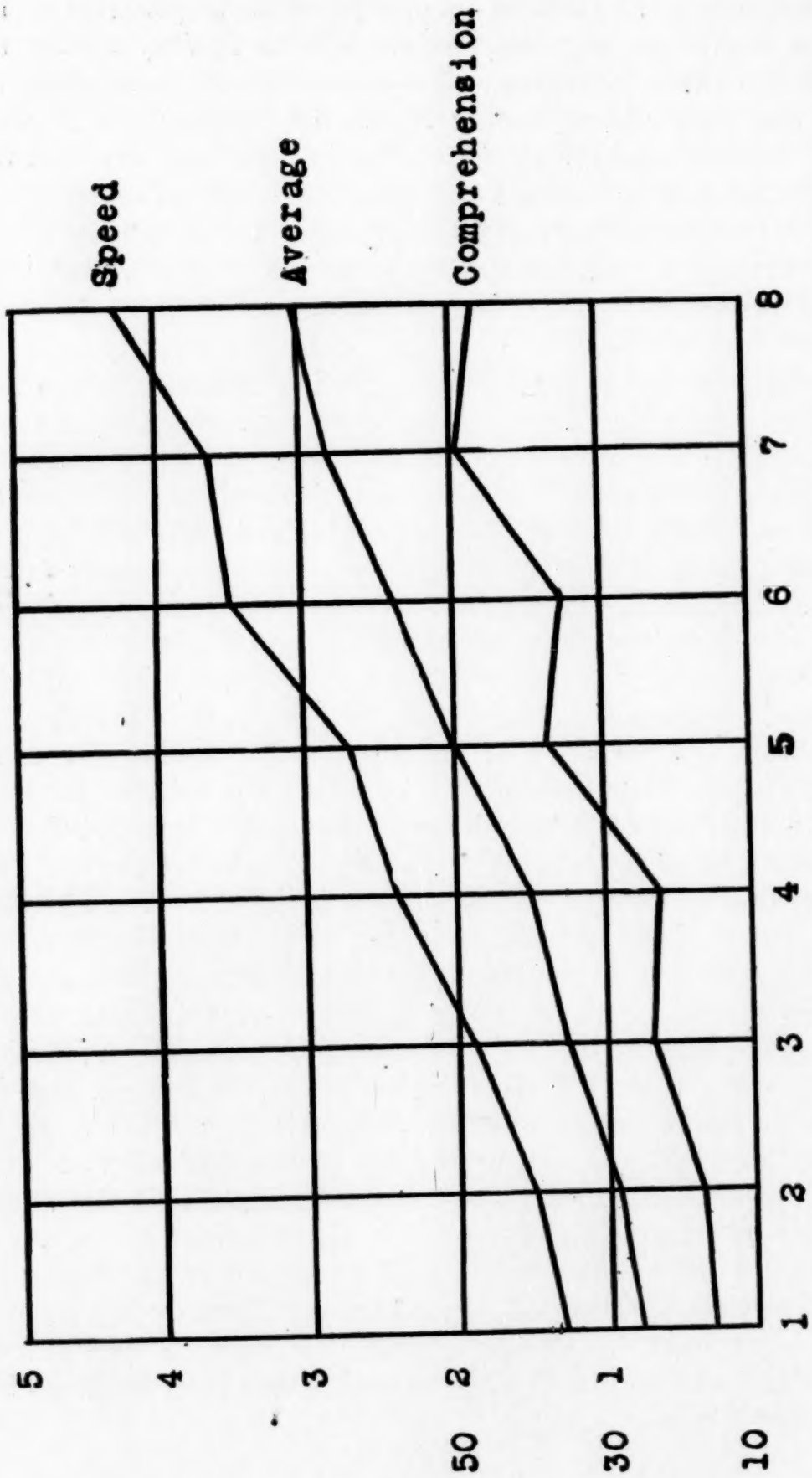


FIGURE 1. The numbers 1 to 8 along the baseline represent the eight testpassages.

Objection to some of the passages might be taken on the ground that they are more or less familiar fables or pieces of literature. But the curves in Fig. 1 give no indication that selection No. 5 about King Midas was read more rapidly or retained more fully than its position demands. There is every indication on the basis of the tests made thus far that the familiarity gained in the ordinary reading in school with any passage will not appreciably affect the tests unless the reading has been done very recently, say within a month preceding the test.

A third point which must be considered in relation to the validity of the tests is the written reproduction of the thought as an index of comprehension. Some pupils may be able to express themselves more readily in writing and others more readily in speaking. Ideally, the comprehension should perhaps be tested by having each pupil state orally in his own words what he had read and by having a stenographic report of his statements. This method would entail much difficulty and require an enormous amount of time, as each child would have to be tested individually, and in the end it might be only slightly, if any, better, as an index of comprehension. The total amount reproduced might be somewhat greater, but it would be no more accurate. A child with a good verbal memory would have the same advantage in either oral or written reproduction. The reproduction in writing is uniform for all pupils. If there is a handicap it would be the same for all. The pupil who is at a distinct disadvantage in writing as compared with speaking is either very rare or fictitious. The pupils in the first grade, and perhaps also to a slight extent the pupils in the second grade, are at some disadvantage in the comprehension scores because of their greater difficulty in writing. This, however, would affect only their comparison with the grades above them and not the relative rank of the pupils within the grade itself.

Further, it might be urged that a fairer test of comprehension would be the reproduction of the thought after a longer interval of time, say a day, instead of immediately. In answer to this we may point out that the conditions of the test would be less uniform, and that the memory factor would be much

more prominent. Some pupils might purposely recall the contents of the selection at various times of the day in order to show up extra well in the results. Immediate reproduction imposes uniformity. Furthermore, recent investigations show a rather high correlation between immediate memory and permanent memory. So that a pupil with a good memory for immediate retention has also a good memory for permanent retention. And so far as the immediate memory span of verbatim reproduction is concerned, the limit of the span is far exceeded in the length of the passages. The immediate span of an adult for words in sentences is approximately 25 words, and that of a child of six about 12 words. This limit is far surpassed in the reading continued for 30 seconds during which the average eight-grade pupil reads 120 words and the average first-grade pupil reads 45 words.

In order to determine from a different angle the validity of these reading tests, a comparison was made between the efficiency in reading as shown by the tests and the efficiency as indicated by the marks in reading assigned by the teachers. This comparison was made in an entire school of 256 pupils. A coefficient of correlation between the results of the tests made at the end of the school year and the marks assigned by the teachers for the year's work in reading was computed for each grade separately, as shown in the following table. The marks in grades one and two were only rough symbols, and hence were not included here. The test in grade seven was not satisfactory, and so is also omitted.

Each pupil was given a rank for both speed and comprehension and also a rank based on the teachers' marks. The coefficients of correlation were then computed from these ranks.[3]

Third grade	.83
Fourth grade	.47
Fifth grade	.55
Sixth grade	.48
Eighth grade	.56
Average	.58

These coefficients show a rather high correlation between the tests and the reading as estimated by the teachers, particularly when we realize the inaccuracy of marks. There is every rea-

[3]These calculations were made by Mr. W. F. Roecker.

son for believing that the real reading capacity of a child is measured fairly accurately by means of these tests, and far more accurately than by the most conscientious marking. A still higher degree of accuracy would be reached if the tests were made at least four times instead of twice, as in the present instance.

Another possible method of testing comprehension would consist in answering selected questions upon the test passages. This method was tried with a group of nineteen pupils using blanks No. 7 and 8. A set of ten questions on each passage was presented to the pupils, who were to answer as many as they could in the allotted time, which was the period required for the quickest pupil to finish. The pupils had the passages before them, and were permitted to consult them freely while answering the questions. The same group of pupils had previously been tested by the other method, and a comparison showed that the question-answer method was less accurate as well as more difficult to score. It requires longer time to score a paper and involves the difficulty as to the value to assign to each answer.

A fourth point regarding the validity of the tests relates to the method of scoring comprehension, namely, of counting the number of written words which correctly express the thought of the test passage. This method was adopted because it is simple, rapid and objective. Two other possible methods might be used. One would consist in ascertaining the number of ideas correctly retained and the other would consist simply in assigning a percentile mark. The latter method has the fatal weakness of being so largely subjective. The former would be ideally the most appropriate method, but it encounters the problem of determining what an idea is and how many ideas there are in each test passage or in each sentence. Thus, if we take the first sentence in selection No. 3 and try to divide the words so that each word or group of words shall relate to one idea, we would have a rather difficult task, and different judges would make very different groupings. For example, is "little" a separate idea, or should "little Abe" be regarded as one idea, or again, is "hurried" a separate idea, or should "hur-

ried along'' be considered as one. All these difficulties are avoided in the word-counting method here used.

In order to obtain a check test on the validity of this method of scoring, ten test papers obtained from ten eighth-grade pupils with selection No. 8 were graded for quantity and quality of thought by the percentile method by ten teachers. At the same time the ten tests were scored by the word-counting method. The comparisons can be seen in the following table:

Test papers.	Av. per cent. mark by 10 teachers.	Mean variation.	No. of words.	No. of words discarded.
1	90.7	4.9	86	7
2	86.0	3.2	75	0
3	80.2	3.2	61	0
4	80.0	3.0	71	5
5	78.2	5.5	66	0
6	75.0	7.0	47	0
7	71.3	9.3	49	0
8	64.4	6.8	46	0
9	63.7	8.7	42	0
10	52.2	8.6	33	0

The word-counting method coincides almost exactly with the average percentile mark assigned by ten teachers. The coefficient of correlation is .95. Hence the method of scoring here adopted is at least as reliable as the combined judgment of ten competent persons and has the very great advantage of rapidity, which is an exceedingly important item in administering the tests on a large scale.

Standards of Efficiency in Reading. In every branch of instruction in the public schools we need a definite standard of attainment to be reached at the end of each grade. If we had such standards and if we had adequate means of precisely measuring efficiency, it would be possible for a qualified person to go into a schoolroom and measure the attainment in any or all subjects and determine on the basis of his measurements whether the pupils are up to the standard, whether they are deficient, how much, and in what specific respects.

The reading tests just described have been made thus far on 3511 pupils in 15 schools in seven cities located in three States, Wisconsin, Minnesota and New York. The tests were administered and scored according to the conditions outlined. On the basis of these results tentative standard scores of efficiency

have been computed for each grade. These standards, presented in the tables and curves that follow, are not the arithmetical averages of the records obtained in each grade, but they are the smoothed values obtained from these averages. As a matter of fact, these smoothed values deviate only slightly from the actual averages. But it is believed that they approximate more nearly to universal standards that would be obtained from tests made in many schools in various cities. The present standard scores, while they must be regarded as tentative, probably do not differ very materially from final standards based on many more tests. As a matter of fact, the averages derived from the first 2000 pupils were not greatly changed by additional tests.

STANDARD SCORES IN READING.

(Smoothed values derived from tests made on 3511 pupils.)

Grades	1	2	3	4	5	6	7	8
Speed of reading (words per second)	1.5	1.8	2.1	2.4	2.8	3.2	3.6	4.0
Comprehension (words written)	15	20	24	28	33	38	45	50

The following table gives the scores made by each of the grades in the 15 schools tested. The averages given at the bottom of the table are not the actual arithmetical averages of the numbers given, because some of the schools were very much larger than others, and their scores were weighted accordingly, so that the averages represent the actual arithmetical averages

SPEED OF READING.

(Scores made in fifteen schools.)

Grades	1	2	3	4	5	6	7	8
City A, School 1	...	1.6	2.0	2.6	3.1	3.5	3.9	3.8
School 2	...	1.5	...	...	...	...	3.9	...
School 3	1.9	2.1	2.4	2.8	...	3.3	2.9	3.2
School 4	...	1.4	2.3	...	...	...	4.5	...
School 5	...	...	...	3.2	2.9	3.8	...	4.5
City B, School 1	...	1.6	2.1	2.4	3.0	3.7	3.8	4.0
City C, School 1	...	1.2	1.7	2.0	2.3	3.1	3.6	3.7
City D, School 1	1.0	1.9	2.5	2.5	2.5	2.9	2.9	3.2
City E, School 1	1.9	...	...	2.7	...	1.9	...	3.5
School 2	2.1	...	...	2.2	2.8	3.1	...	...
School 3	1.8	2.3	1.7	2.3	...	...	...	...
School 4	1.9	2.6	...	1.9	...	...	...	...
School 5	2.3	2.3	3.1	1.6	...	3.3	5.2	3.9
City F, School 1	1.2	1.6	2.0	2.6	3.0	3.3	3.2	4.1
City G, School 1	1.0	1.8	1.3	2.0	2.0	2.7	3.1	4.1
Averages	1.6	1.9	2.1	2.4	2.7	3.2	3.7	3.8

COMPREHENSION OF READING.

(Scores made in fifteen schools.)

Grades	1	2	3	4	5	6	7	8
City A, School 1	....	16.9	22.2	31.6	37.0	40.3	46.3	50.7
School 2	....	27.9	....	....	....	....	53.5	....
School 3	17.4	24.6	31.7	33.8	....	35.7	35.3	40.6
School 4	....	28.1	41.6	....	....	....	54.2	....
School 5	....	....	....	35.3	47.3	48.3	....	50.8
City B, School 1	....	18.5	21.5	24.6	29.4	37.2	49.6	56.4
City C, School 1	....	13.8	19.2	22.8	29.1	38.2	50.2	57.0
City D, School 1	16.8	20.0	38.2	26.4	32.0	35.2	36.6	45.2
City E, School 1	....	....	....	35.7	....	28.8	....	44.5
School 2	....	....	....	17.6	33.8	38.2	....	....
School 3	....	21.6	25.4	25.7	....	....	....	....
School 4	....	21.2	....	23.8	....	....	....	....
School 5	17.5	20.4	24.3	23.3	....	43.3	51.3	36.9
City F, School 1	....	21.6	21.9	21.4	33.0	32.6	36.4	53.3
City G, School 1	6.5	15.6	21.8	16.0	28.1	36.7	44.7	55.1
Averages	13.8	20.9	26.9	25.2	33.7	37.7	46.0	49.1

of the total number of pupils. All the tests were made at the end of the school year, with the exception of three schools, which were tested in January. Their scores were weighted so as to represent the estimated values that would be attained at the end of the school year. This was necessary in order to obtain final averages which would represent the achievement attained at the end of each grade.

The degree of efficiency can be represented most simply either by curves drawn, as in Figs. 2 and 3, or by graph charts, as in Figs. 4 and 5. The vertical columns in these charts represent the eight grades. The two horizontal lines are the standard scales for speed and comprehension. The division points on each scale are so placed that the middle point for any column represents the standard for that grade, as shown in the table of standard scores. Thus the graph of a pupil in the third grade who is exactly up to the standard in every respect would be a straight line down the middle of the third column.

By means of the standard curves it is possible to measure quite accurately the actual attainment in reading of individual pupils, of an entire grade, of an entire school, or of a whole school system. Fig. 4 shows the comparison of an elementary school of 401 pupils in a city of 40,000 population with the standards. Fig. 5 gives the results of a test in a small city of about 2000 population. There is considerable deficiency in nearly all grades in the latter city, which is probably due to the

large foreign element. Some of the pupils wrote their tests in a foreign language.

Individual Differences and the Overlapping of Grades.—One of the most important, if not the most important, discovery of the recent measurements of efficiency in school studies is the enormous range of differences in capacity shown by the pupils in the same class or grade. There is a tacit feeling that when a pupil is promoted to the next higher grade his capacity is distinctly superior to the average ability of the pupils left behind, and that the pupils of any given grade, while not alike, are individually and collectively superior to the average or even to the better ones of the next lower grade.

It is, therefore, most surprising to find that the abilities shown by the pupils of any grade, with the possible exception of the first and second, are distributed over the entire scale. For example, there are pupils in the fourth grade whose attainment in reading is higher than that of the average eighth-grade pupil. Likewise there are pupils in the fourth grade whose attainment in reading is inferior to that of the average first-grade pupil.

To show these facts concretely, the distributions of the reading abilities of the pupils in the fourth and fifth grades of city 1, school 1, are shown in the charts of Fig. 6. Each pupil is represented by a dot which is placed above the base line, so that it will indicate the pupil's capacity. For example, there is one pupil in the fourth grade whose speed of reading is 2.0 words per second, there are two pupils whose speed of reading is 2.1 words per second, etc. The first chart at the top shows the distribution of the pupils in speed of reading, the middle chart shows the distribution of the same pupils in comprehension, and the one at the bottom shows the distribution of these pupils in speed and comprehension combined. In this third chart speed and comprehension are arbitrarily given equal weight and a single score is assigned to each child. The two elements are combined so as to avoid the possible objection that might be made to the effect that pupils might differ very much in speed or in comprehension separately, and that the pupil who reads rapidly might comprehend little, and vice versa, and that if due weight were given to both elements the final capacities

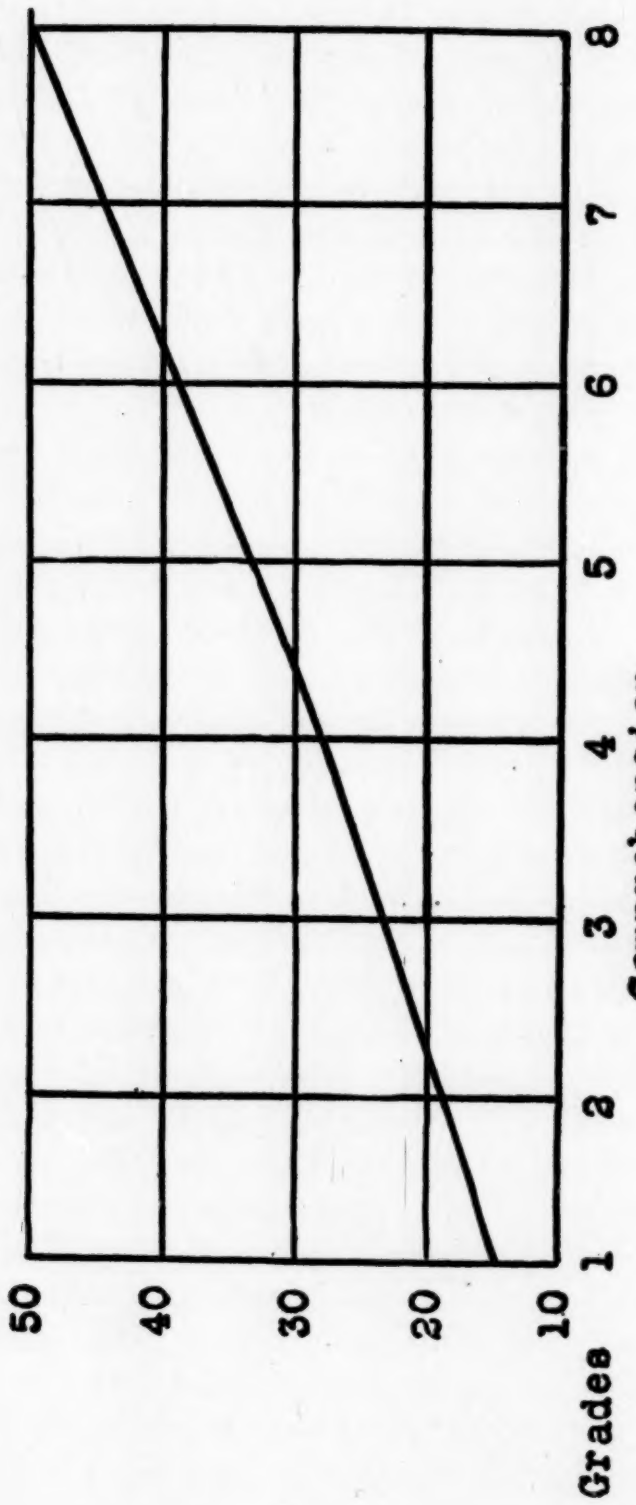


FIGURE 2.

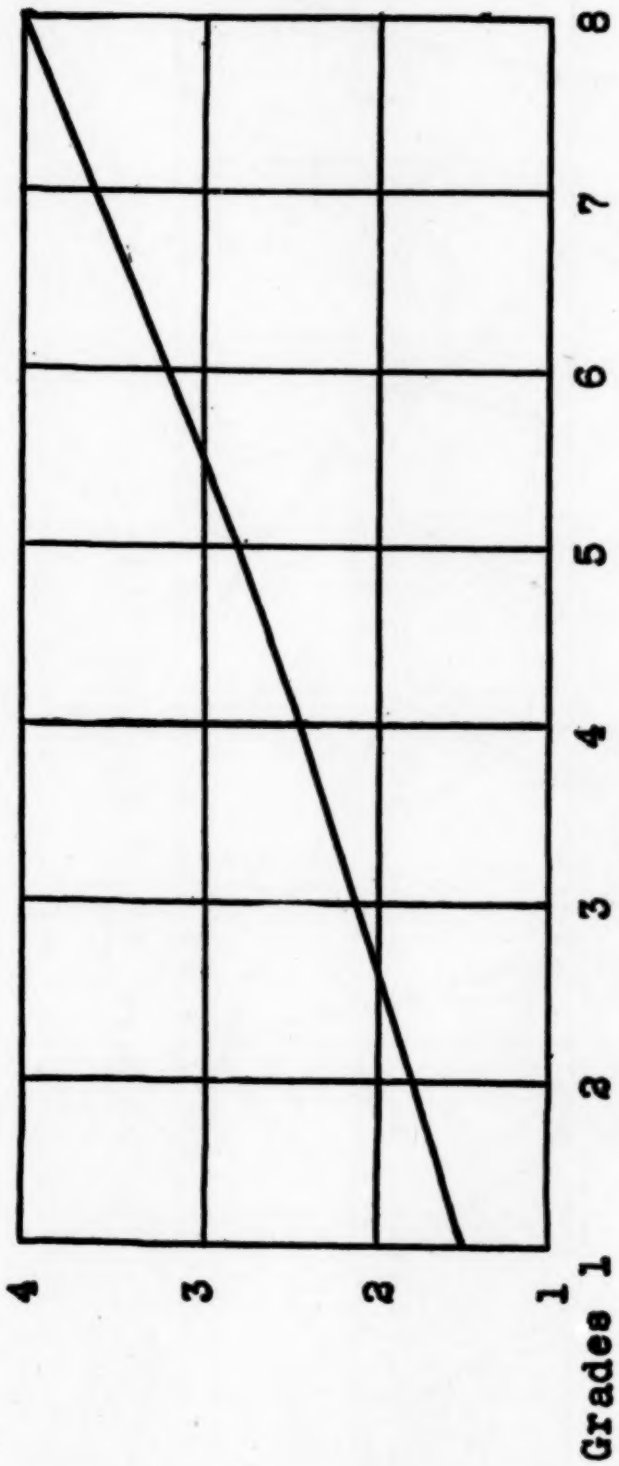


FIGURE 3.

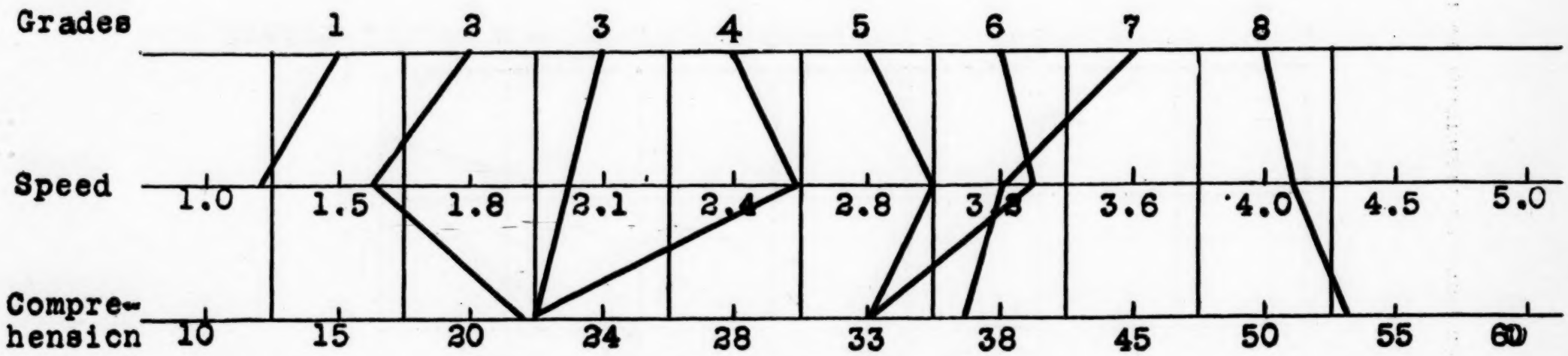


Figure 4. Tests in City F.

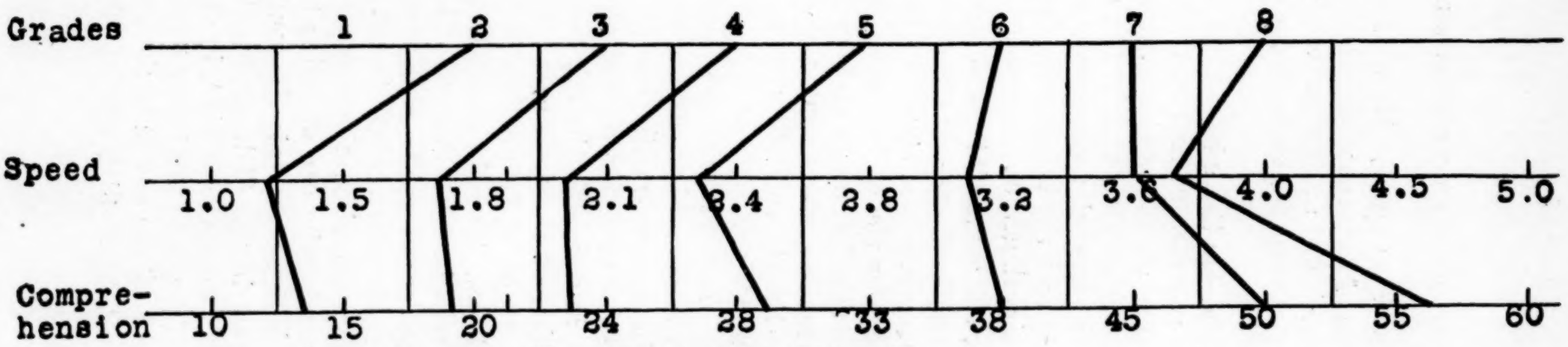


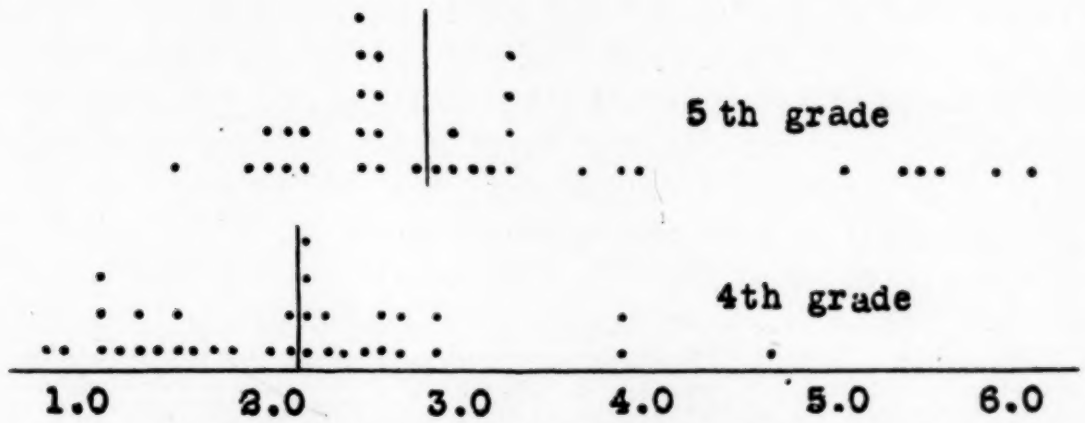
Figure 5 . Tests in City C.

might not differ nearly so much. Now, it will be seen at a glance that the ranges of difference in either speed or comprehension or in both combined are astoundingly wide, and that they are practically the same for either element or for both together.

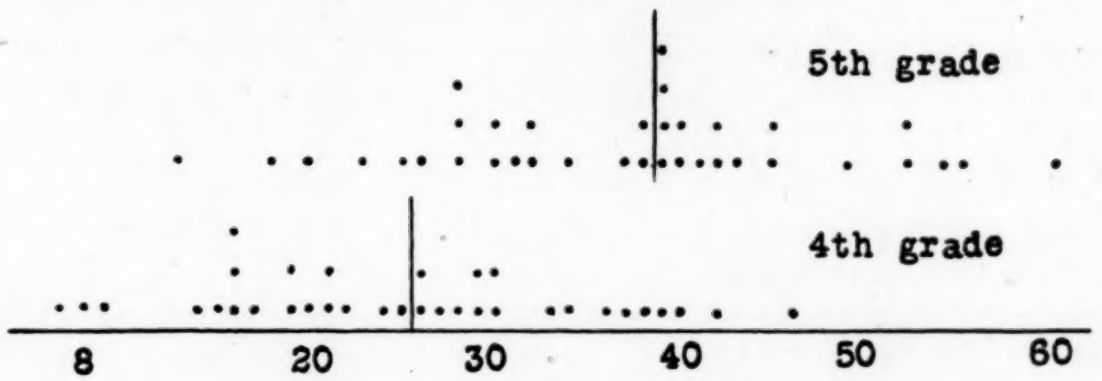
Thus in the fourth grade there is one pupil whose speed of reading is .8 words per second and one whose speed is 4.7 words per second. The standard score for speed in the first grade is 1.5 words per second, and in the eighth grade 4.0 words per second. The one falls considerably below the standard of the first grade and the other rises considerably above the standard of the eighth grade.

In comprehension, the same statement holds. There is one pupil in the fourth grade whose score is seven words and one whose score is 46 words. The standard score for the first grade is 15 words and for the eighth grade 50 words. In the chart which combines speed and comprehension, the best pupil in the fourth grade made a score four and one-half times as high as the poorest. Surely such differences among pupils in the same grade are startling.

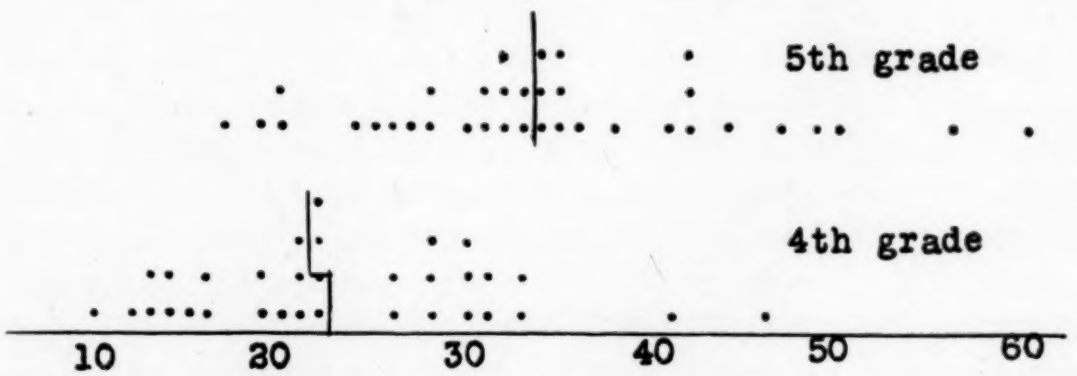
The next significant fact which necessarily accompanies the wide differences in attainment is the large amount of overlapping of the abilities in one grade with those of the next. A concrete example of the extent of the overlapping is exhibited in the charts of Fig. 6, in which the fourth and fifth grades are placed above each other on the same base line, so that a direct comparison can be made. The median is indicated in each chart by the vertical line. Thus in speed of reading there are only six out of 36 pupils in the fifth grade who are superior to the best pupil in the fourth grade, and only 9 out of the 34 pupils in the fourth grade who are inferior to the poorest in the fifth grade. In comprehension, there are likewise only six pupils in the fifth grade who are superior to the best in the fourth grade and only three pupils in the fourth grade who are inferior to the poorest in the fifth grade. Expressing these facts in another form, we may say that, in speed, 80 per cent. of the pupils in the fifth grade fall below the best in the fourth grade, and 74 per cent. of the pupils in the fourth grade reach or surpass the poorest in the fifth grade. Taking both speed



Distribution of pupils in speed of reading



Distribution of pupils in comprehension of reading



Distribution of pupils in speed and comprehension
The vertical lines show the location of the medians

and comprehension together (lower chart in Fig. 6), exactly 80 per cent. of the pupils of either grade (89 per cent. of the fifth and 71 per cent. of the fourth) fall within the range of the other grade. Or, exactly 60 per cent. of the pupils of either grade could be replaced by an equal number from the other grade without affecting in the slightest the reading efficiency of either class. The difference between 80 per cent. and 60 per cent. is due to the fact that if 80 per cent. of the pupils in the fourth grade were transposed into the fifth grade there would be a larger proportion of poor pupils in the fifth grade than is found there at present. Likewise if 80 per cent. of the pupils in the fifth grade were transposed into the fourth grade there would be a larger proportion of good pupils in the fourth grade than is found there at present. If as many pupils of one grade, who have the same abilty as an equal number of pupils in the other grade, were to be transplanted, then the percentage reduces itself to 60.

A study similar to that shown in Fig. 6 was made of all the grades in three schools, each in a different city. The results were identical in every respect with those shown in Fig. 6. The range of differences and the overlapping was just as large. In addition it was found that, in speed and comprehension combined, 31.8 per cent. of the pupils of any grade reached or exceeded the median of the next grade above, 20.1 per cent. reached or exceeded the median of the second grade above, 13.2 per cent. reached or exceeded the median of the third grade above, and 3.3 per cent. reached or exceeded the median of the fourth grade above. In other words, one-third of the pupils of any given grade could do the reading work of the next grade above as well as the average of that grade, one-fifth could do the work of the second grade above it as well as the average of that grade, and one-eighth could do the work of the third grade above it as well as the average of that grade. Likewise, corresponding percentages of pupils in any given grade are no more efficient in reading than the average of one, two or three grades below it.

Should these differences be taken into account in our schools? Should the pupils be reclassified into higher or lower classes according to their capacities? The facts presented here reveal the situation as it actually exists at the present time.

A SCALE FOR MEASURING FREE-HAND LETTERING.

HAROLD ORDWAY RUGG,
University of Illinois.

I. Principles and Method of Its Design.

In March, 1914, as a result of some two years' research, the writer submitted for the consideration of students of education and teachers of engineering lettering, a Scale for Measuring Free-hand Lettering. The aim of the entire study in this field has been (a) to design a scale for the measurement of free-hand lettering which can be efficiently used by teachers and students of engineering drawing, both in secondary and higher technical schools; (b) to so further the standardization of the teaching process in engineering lettering that practically all students might be enabled to develop all necessary skill through such incidental training in lettering as can ordinarily be given in the usual course in mechanical drawing. The opportunity is now presented of stating briefly the principles of design of such a scale, together with a preliminary critique of its use by teachers and students in the classroom.

The Function and Necessary Criteria of a Scale in Lettering.

1. The scale should be designed to be a definite classroom aid to both teachers and students of lettering in higher and secondary technical schools.

2. It should aid the instructor by enabling him (a) definitely to evaluate samples of student lettering and to assign them numerical grades; (b) to judge of the rapidity of a student's progress as compared with that of an average class using the Standard Method; (c) to solve more easily the daily difficulties encountered by his students; (d) to foresee the pitfalls in the development of skill in lettering by students of varying grades of ability and to devise methods of avoiding

them; (e) to know the effect of the "time" element on the development of skill of various types of students.

3. The scale should aid the student by enabling him numerically to grade his own lettering product; to compare his rate of progress with that of a normal class having the same previous training; more accurately to detect his errors in technique; to know the most efficient rate of speed to follow at various periods throughout the semester.

4. To accomplish these aims, any efficient scale must fulfill the following conditions: (a) It must be a numerical measure; (b) it should be based on an absolute system of marking alike for all samples used; (c) it should be made up of samples obtained under normal classroom conditions using the method suggested; (d) the samples should be arranged by equal intervals for the entire range of ability found in a normal class; (e) it should be easy to use and adaptable to any secondary or college class in mechanical drawing.

How This Scale Was Designed.

A. The Form or "Copy."

To obtain representative samples of student lettering a standard form or "copy" was required based on the principle that the frequency of letters in the form should be in proportion to (a) the relative difficulty of execution of the letters of the alphabet, (b) the frequency of their occurrence on representative engineering drawings. (For a complete description of the design of the form see the original descriptive pamphlet and Scale. These may be secured on request from the writer.) Since the data based on the principle of "letter difficulty" were not at hand, the design of the form was based on the principle of frequency of occurrence of letters on engineering drawings.

B. Securing the Samples for the Scale.

The form mentioned was designed and adopted for use in 1913 in all the sections of the Department of General Engineering Drawing, University of Illinois. Beginning with the second day of the first week's work in drawing, the writer conducted a daily lettering drill throughout the semester of 15 weeks. This class drill consisted of three lines of the Standard

Form, the elapsed time being announced by the instructor and recorded by the student. During the first four weeks the drill was preceded by discussions with each student of errors, best methods of procedure, etc. Faults (which are known from previous experimentation to appear at certain intervals) were pointed out and emphasized through brief blackboard talks to the class. After the first four weeks the personal talks with individual students were generally discontinued and brief general directions given to the class. Each student was always asked to do his best work regardless of the speed of his neighbor. In general this result was obtained and there has been evinced a very high degree of interest on the part of the student in a sort of technique which is generally considered to be tedious and devoid of interest to the student and teacher alike.

C. Scoring and Selection of Samples for the Scale.

Various methods of scoring have been studied and laboriously experimented with by the writer during the past year. The method finally adopted, with the underlying principles, may be analyzed thus:

1. The fundamental aim in lettering is to teach students "to make neat letters quickly."

2. Neatness in lettering may be taken as synonymous with "of good appearance."

3. Good appearance is believed to depend primarily upon "uniformity" in the construction of each individual letter and the combination of various letters into words.

4. All Reinhardt lettering may be analyzed into its four component elements, viz., heights of letters, spaces (both between letters and between words); stems (vertical, horizontal and slant), and ovals.

5. Uniformity of lettering is a composite of uniformity of heights of letters, spaces between letters and words, stems and ovals, and may be expressed algebraically as follows: $A = H \times k_1 + Sp \times k_2 + St \times k_3 + Ov \times k_4$, in which A equals the ability to letter as shown by a given sample, and H, Sp, St and Ov are percentages of heights, spaces, stems and ovals, respectively, found to be correct in the whole form, and where the k's are constants depending upon the weights to be given to the

various elements in lettering, k_1 for heights, k_2 for spaces, k_3 for stems, and k_4 for ovals.

6. The numerical value to be given the constants k were finally fixed in the following manner: Various words in the form were lettered by the writer, certain types of errors being purposely made. Comparison of results made it apparent that lack of uniformity in heights and spaces had a larger effect on the "good appearance" of the lettering than lack of uniformity in the construction of stems and ovals. Further to test this point, a preliminary grading was made of the samples obtained in the first week, assigning various values to the k's for each of the four elements. Making all the values of k equal to .25 tends to undergrade the samples from the point of view of "good appearance." It was believed by the writer that making k_1 and k_2 .30 and k_3 and k_4 .20 underestimated the true effect of heights and spaces. The following values of k were finally empirically assigned: k_1 and $k_2 = .33$; k_3 and $k_4 = .17$, and were used throughout the computation. Thus the fundamental criterion upon which these samples have been graded is that weight should be given to those elements in which the greatest proficiency occurs. And careful examination of the tabulated scores throughout the semester shows that a much larger proficiency was obtained in the determination of heights and spaces than in the construction of stems and ovals. In critical examination of the values assigned to each of the k's it should be remembered that the difference in numerical grade obtained from the samples by using k_1 and $k_2 = .33$ and k_3 and $k_4 = .17$ is on the average less than 2 per cent. higher than that obtained by using k_1 and $k_2 = .30$ and k_3 and $k_4 = .20$, and only 3 per cent. higher than that obtained by weighting all elements alike, *i. e.*, in making all the k's = .25.

7. The determination of the method of scoring the samples and the final values of "A" was the result of laborious experimentation and computation in the grading of samples, carried out as follows: Two methods were used: 1. The method of "general impression" of uniformity. 2. The method of counting specifically the number of correct heights, spaces, stems and ovals in each of the samples, with the accompanying computation of the final grade of each sample by the use of the

above equation. By the first method the samples of the first week's work were arranged in order of general merit as determined by the "general impression" of good appearance. This ranking in order was carried through independently three times, the final ranking of each sample being determined by the closest approximation to the mean position of the ranking.

By the second method the total number of single operations in the three-line form was counted, these totals being, heights (letters), 176; spaces (both between letters and words), 167; stems, 173; ovals, 181. The percentage of correct number of heights, spaces, stems and ovals was next computed, tabulated and the resultant grade or ability "A" as shown in each sample was computed from the above equation. The order of the samples as ranked by this method was then compared with the order obtained by the method of "general impression." Nine of the first 10 samples occupied the same position in both orderings. The first 20 as scored by "impression" included 16 as scored by "counting"; the first 30 as scored by "impression" included 26 as scored by "counting." Careful examination of the two rankings showed that in general the arrangement of the samples by the two methods was very nearly identical.

Whereas the first method of grading gives only a qualitative ranking of samples and offers no indication of the quantitative interval between any two samples, and the second method, while ranking in the same general order, also gives a definite numerical grade to each sample, it was decided to score all samples throughout the semester by the "counting" method. The samples for the entire semester (1500 in all) were then scored by the writer by this detailed method. The number of single operations on each sample being separately counted and tabulated, the per cent. of correct strokes were computed and used in the efficiency equation by introducing the proper coefficients. Thus the scoring and selection of samples for this Lettering Scale has involved the counting and judging of the accuracy of something over 100,000 single strokes, with the necessary accompanying tabulation and computation.

8. The next and final step in the construction of the Scale was the selection of the specific samples which should go into its makeup, they being so selected that the interval between

any two consecutive steps should be constant, and the total range being taken as the numerical distance between the model copy and the lowest graded sample (98-29.8 per cent.) All samples whose grades fell between any of the intervals, 89.5-90.5; 79.5-80.5; 69.5-70.5; 59.5-60.5; 49.5-50.5; 39.5-40.5; 29.5-30.5; were next selected and arranged in separate groups, each group being arranged by "impression" in order of general merit. The most representative sample in each group was then selected to occupy a position on the Scale corresponding to the grade of that group. This results in a Scale of eight samples, ranging by intervals of approximately 10 per cent. each, from 100 per cent. to 30 per cent. It is believed that the samples selected are typical of their group, and that the intervals on the Scale as thus determined are for all practical purposes equal. The complete Scale reproduced herewith is a full-sized reproduction of these samples as originally mounted in the order of their excellence.

Outline of the Method of Using the Scale in Teaching Free-Hand Lettering.

The development of the ability in students to make "neat letters quickly" (our fundamental aim) involves a teaching process including at least the five following steps: 1. The exposition of the necessary facts and principles. 2. Creation of right attitudes on the part of the student. 3. The presentation of the necessary "mechanics of method." 4. Establishment of right habits of thought. 5. The building up of specific habits of finger and wrist technique. It is to the carrying out of the last of these steps that the administration of our Scale can contribute. An outline of the method of its use in the classroom follows:

A daily lettering drill (8 to 15 minutes in length) is held about the middle of the drawing period throughout the semester of 15 weeks, procedure being as follows:

1. After short general class directions as to specific elements of lettering to which various members of the class should be paying the most attention and caution as to the amount of time used, the entire class, beginning work at the same time,

letters a three-line block of the Standard Form. As each student completes his block the instructor states the elapsed time (in minutes and seconds), this result being lettered by the student in the proper place on the form.

2. The student then turns to his Scale (each student has one of his own), and compares his sample with those of the Scale, moving both up and down the sheet and grading twice, finally assigning the sample a numerical grade.

3. The instructor carefully checks the grading of each student's samples, suggesting revision of grade where necessary, with such thorough explanations as to enable the student to train his own judgment through future practice.

4. The student plots his grade and time on the proper ordinate of the Practice Curve cross-section (page 4 of the Scale), and compares critically the shape of his curve to date with that of the practice curve of the "average" class shown on page 3 of the Scale. It has been found to expedite matters to have all grading and plotting done once a week at the third exercise.

II. Preliminary Critique of the Lettering Scale.

In September, 1914, the Department of General Engineering Drawing of the University of Illinois adopted for trial during the current year both the Lettering Scale and the complete method outlined for its use. It has been used daily by six instructors and 300 students, and is also being experimented with in six other institutions. After eight weeks of classroom use by both teacher and student we are now in a position to report briefly a preliminary critique of the efficiency and practicability of the Scale itself. To do so in the brief space allotted to this article, it will be possible to publish only the statistical summary of results. (All of the original data concerning the design of the Scale and its critical application in the classroom are on file at the University of Illinois and may be inspected by those interested.)

We submit below: 1. Data showing the efficiency with which beginning students (never having seen the Scale and having had no training in engineering lettering) were able to arrange in order of merit the samples of the Scale. Table 1 presents

A SCALE FOR MEASURING FREE HAND LETTERING

FOR TECHNICAL COLLEGES AND SECONDARY SCHOOLS

HAROLD ORDWAY RUGG, C.E.

Efficiency in Lettering–Practice Daily Letters Most Frequently Used

Material Finished Cast Steel	Section Gear Parts Keyways	Shaft Bearing
Required Name Number View	Drill Holes Mast Studs Cover	Bronze Pipes
Dimension All Detail Drawings	Taper Joint Lock Nuts Mixer	1234567890

100

Material Finished Cast Steel	Section Gear Parts Keyways	Shaft Bearing
Required Name Number View	Drill Holes Mast Studs Cover	Bronze Pipes
Dimension All Detail Drawings	Taper Joint Lock Nuts Mixer	1234567890

90

Material Finished Cast Steel	Section Gear Parts Keyways	Shaft Bearing
Required Name Number View	Drill Holes Mast Studs Cover	Bronze Pipes
Dimension All Detail Drawings	Taper Joint Lock Nuts Mixer	1234567890

80

Material Finished Cast Steel	Section Gear Parts Keyways	Shaft Bearing
Required Name Number View	Drill Holes Mast Studs Cover	Bronze Pipes
Dimension All Detail Drawings	Taper Joint Lock Nuts Mixer	1234567890

70

Material Finished Cast Steel	Section Gear Parts Keyways	Shaft Bearing
Required Name Number View	Drill Holes Mast Studs Cover	Bronze Pipes
Dimension All Detail Drawings	Taper Joint Lock Nuts Mixer	1234567890

Required Name Number View	Drill Holes Mast Studs Cover	Bronze Pipes
Dimension All Detail Drawings	Taper Joint Lock Nuts Mixer	1234567890

60

Material Finished Cast Steel	Section Gear Parts Keyways	Shaft Bearing
Required Name Number View	Drill Holes Mast Studs Cover	Bronze Pipes
Dimension All Detail Drawings	Taper Joint Lock Nuts Mixer	1234567890

50

Material Finished Cast Steel	Section Gear Parts Keyways	Shaft Bearing
Required Name Number View	Drill Holes Mast Studs Cover	Bronze Pipes
Dimension All Detail Drawings	Taper Joint Lock Nuts Mixer	1234567890

40

Material Finished Cast Steel	Section Gear Parts Keyways	Shaft Bearing
Required Name Number View	Drill Holes Mast Studs Cover	Bronze Pipes
Dimension All Detail Drawings	Taper Joint Lock Nuts Mixer	1234567890

30

Material Finished Cast Steel	Section Gear Parts Keyways	Shaft Bearing
Required Name Number View	Drill Holes Mast Studs Cover	Bronze Pipes
Dimension All Detail Drawings	Taper Joint Lock Nuts Mixer	1234567890

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the tabulated results as submitted by each of seventy-four students, typical tendencies being indicated by the summary. 2. Data showing relative efficiency of students and instructors in grading samples of student lettering, some without the Scale and some with the Scale. Table 2 presents the data, itemized as follows:

A. The average grade given by seven instructors and thirty-eight students, to twenty samples of lettering done by students in the writer's classes, samples so selected as to give approximately an equal distribution above and below 75 per cent. This average grade is regarded as the "true grade."

B. The mean variation from the True Grade of the grades assigned to each of the twenty samples by (1) the seven instructors of the department; (2) sixteen students in one of the writer's classes; (3) twenty-two students in one of Mr. F. M. Porter's classes. All students and instructors had used the Scale in the classroom during eight weeks.

C. The mean variation from the True Grade assigned to each of twenty samples by (1) the seven instructors of the department previous to having used the Scale in grading samples of student work, their basis of marking being that of the previous practice in the department as interpreted by the individual men; (2) twenty-two students of one of the writer's classes, trained in the use of the Scale (to the extent of not more than fifteen minutes' practice per week for eight weeks). In this case the grading of samples was without the use of the Scale, the students being asked to grade the sample in accordance with their memory of the quality of work represented by each of the samples on the Scale; (3) sixteen students in another of the writer's classes, all freshmen engineers, previously trained in drawing and lettering, but never having seen the Scale. This group was asked to grade according to their own best judgment, a brief explanation being written on the blackboard of the nature of the four essential elements of lettering and the way in which uniformity of sample was to be considered as fundamental in marking. All the grading above mentioned was done under the supervision of the writer.

3. Data giving (a) the practice curves (quality and time) of thirty-one students in the writer's classes during the first

semester, 1913-14, using the system of teaching at that time developed, but not having access to a Lettering Scale for measuring progress. (b) Similar practice curves (quality and time) of thirty-seven students in the writer's classes during the first seven weeks of the current semester, using the improved system and the Lettering Scale.

The results of several weeks' critical study of student work and our statistical data, coupled with the very helpful criticism of three members of the drawing department, enable us to comment as follows on results of using the Lettering Scale.

A. Efficiency With Which Beginning Students Arranged the Samples of the Scale in Order of Excellence.

From a study of Table 1, giving the number of students arranging the samples in order with no mistakes, one mistake, two mistakes, etc., and the number of steps which the various samples were arranged out of place by various students, we can conclude as follows: 1. The upper and lower samples on the Scale are separated by such distinct intervals as to be correctly recognized by practically all untrained students. Samples 80, 70, 60 and 50 are separated by such intervals as to be correctly recognized by two-thirds of any group of such untrained students. In the case of these samples the proportion of the students misplacing each sample by one step is for the 80 per cent. sample, one-third; for the 70 per cent. sample, one-fifth; for the 60 per cent. sample, one-third; for the 50 per cent. sample, two-fifths. Questioning the students brings out the fact that in the case of practically all, the sample misplaced was always so placed after considerable debate over the question (1) of the relative emphasis to give to different elements in the sample; (2) of extraneous elements, neatness, heaviness of line, peculiar style of stroke, etc. This latter element was considered in detail by the writer in designing the Scale, and the attempt was made in selecting the specific samples for the Scale to take only those samples which not only "counted right," but which would also emphasize some distinctive quality as we proceed up the Scale. It is clear that this was successful to the extent of being recognized by all of the students at the upper

TABLE 1.

The order in which 74 beginning students arranged the 8 samples of the Lettering Scale.

No. of student.....	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Samples:																								
100%	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
90%	2	2	2	2	2	2	2	2	2	3	3	4	2	2	2	2	2	2	4	2	2	2	2	2
80%	3	3	3	3	3	3	3	3	3	2	2	3	4	3	3	4	4	3	3	3	3	3	3	3
70%	4	4	4	4	4	4	4	4	4	4	4	2	3	4	4	3	3	4	2	4	4	4	4	4
60%	5	5	5	6	5	6	6	6	6	6	5	6	6	5	5	5	6	5	5	5	6	5	6	5
50%	6	6	6	5	6	5	5	5	5	5	6	5	5	6	6	6	5	6	6	6	5	6	5	6
40%	7	7	7	7	7	7	8	7	7	7	8	7	7	7	7	7	7	7	7	7	7	7	8	7
30%	8	8	8	8	8	8	7	8	8	8	7	8	8	8	8	8	8	8	8	8	8	8	7	8
None interchanged.....	x	x	x	..	x	..	..	..	..	..	..	..	..	x	x	..	..	x	..	x	..	x	..	x
1 "	..	..	..	x	..	x	..	..	x	..	..	..	..	..	..	x	..	..	x	..	x	..	..	..
2 "	..	..	..	..	..	..	x	x	..	x	x	x	x	..	..	..	x	..	..	..	..	..	x	..

No. of student.....	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
Samples:																									
100%	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
90%	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	3	2	2	2
80%	4	3	3	3	3	3	3	3	3	3	2	3	4	3	4	2	3	3	4	4	3	2	3	3	4
70%	3	4	4	4	4	4	4	4	4	4	5	4	5	4	3	4	4	4	3	5	4	4	4	4	3
60%	6	6	6	6	5	5	6	6	5	5	4	5	3	6	6	5	5	5	5	3	5	5	5	5	5
50%	5	5	5	5	6	6	5	5	6	7	6	6	6	5	5	6	6	6	6	6	6	6	6	7	6
40%	8	7	7	7	7	8	7	7	7	6	7	7	7	7	7	7	7	7	7	7	7	7	7	6	7
30%	7	8	8	8	8	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
None interchanged..	..	..	..	..	x	..	..	..	x	..	..	x	..	..	..	..	x	x	..	..	x	..	x	..	..
1 " ..	..	x	x	x	..	x	x	x	..	x	..	..	..	x	..	x	..	..	x	..	..	x	..	x	x
2 " ..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	x	..	..	..	..	x	..	..	..	..	..
3 " ..	x	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..

No. of student.....	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74
Samples:																									
100%	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
90%	2	2	3	2	2	2	2	2	2	2	3	2	2	2	2	2	2	4	2	2	2	2	2	2	2
80%	3	3	2	4	4	3	3	3	3	3	2	3	3	4	6	3	3	2	3	4	3	4	3	4	4
70%	4	4	4	6	3	4	4	4	4	4	6	4	4	3	3	4	4	6	4	3	4	3	4	3	3
60%	5	6	6	3	5	5	5	6	5	5	4	5	5	6	4	5	5	3	6	5	5	6	5	5	5
50%	6	5	5	5	6	6	6	5	6	6	5	6	6	5	5	6	6	5	5	6	6	5	6	6	6
40%	7	7	7	7	8	7	7	7	8	7	8	8	7	8	8	8	7	8	7	7	7	7	7	7	7
30%	8	8	8	8	7	8	8	8	7	8	7	7	8	7	7	7	8	7	8	8	8	8	8	8	8
None interchanged..	x	..	..	..	..	x	x	..	..	x	..	..	x	..	..	..	x	..	..	..	x	..	x	..	..
1 " ..	..	x	..	..	..	..	..	x	x	..	..	x	..	..	..	x	..	..	x	x	..	..	..	x	x
2 " ..	..	..	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..
3 " ..	..	..	..	x	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..
4 " ..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	x	..	..	..	..	..	..	..	..	..	..
5 " ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..

and lower range and by two-thirds of them in the middle range. The one place error of the remaining one-third of the students at least raises the question whether the attempt should not be made to obtain samples which will score correctly for each position of the middle range and have at the same time a quality so distinctive of their position on the Scale that all untrained students would arrange them in precisely the right order. In the Slant Lettering Scale, upon which the writer is now working, this characteristic of distinctive "style" is being taken care of by making up three scales, all of whose samples score correctly, but at the same time giving three distinct "characters" in lettering, with each individual scale emphasizing a constant weight of line peculiar to it alone.

B. Results of Grading Twenty Samples of Student Lettering, With and Without the Scale.

Critical study of the above summary table and of the detailed data from which the main variations were obtained leads to the following conclusions:

1. The true grades on each of eight of the samples as expressed by average grades of forty-five judges lies above 75 per cent., and the true grades of twelve samples lies below 75 per cent.

2. The mean variations from true grade given to the samples by instructors and students when grading with the Scale run so closely together as to indicate that the limited training received, functioned to enable students to judge the quality of student lettering as efficiently as their instructors. Mean variations of all grading done by students is 5.92 per cent.; that of instructors, 5.31 per cent.

3. Samples of 50-60 per cent. quality can be judged as accurately with the aid of the Scale as those of a quality above 80-85 per cent.

4. When marking without the aid of the Scale and not having agreed upon a common standard, instructors show twice as much mean variation (10 per cent. to 5 per cent.) with samples grading below 75 per cent. as with those above 75 per cent. There is quite evident here the "high marking" personal equa-

TABLE 2.

Mean Variations (in Per Cent.) from the True Grade, of Grades Given by Instructors and Students.

No. sample.....	8	7	2	10	18	12	Ave. of	3	19	Ave. of	
True grade.....	89.3	88.9	87.0	85.6	84.4	83.2	M. V.	77.0	73.1	M. V.	
7 instructors....	3.5	4.5	3.2	4.4	4.5	3.3	4.2	4.5	6.0	(5.3)	with scale.
16 students.....	4.0	5.6	6.0	5.4	5.2	6.6	5.5	4.5	5.6	5.1	" "
22 students.....	5.6	4.5	3.9	3.5	4.6	3.8	4.3	6.6	6.6	6.6	" "
23 students.....	5.1	4.2	4.0	5.4	4.7	3.5	4.5	3.4	6.0	4.7	Trained on scale, but graded without.
13 students.....	3.7	4.2	6.1	2.8	4.8	7.0	4.8	7.6	5.8	6.7	Never had seen the scale.
7 instructors....	3.6	4.9	4.1	4.9	4.7	7.1	4.9	4.6	7.1	5.8	Without scale before having graded with it.

No. sample.....	1	5	16	11	13	20	Ave. of	4	17	15	14	Ave. of	6	9	Ave. of
True grade.....	68.5	68.4	65.2	65.2	60.5	60.0	M. V.	58.6	56.2	50.9	50.2	M. V.	48.9	44.6	M. V.
7 instructors....	6.7	5.0	11.3	6.7	6.2	6.7	7.1	5.8	6.3	5.0	4.2	5.3	3.3	5.8	4.5
16 students.....	7.0	5.9	7.2	6.4	6.3	7.1	6.7	7.9	5.0	5.8	5.5	6.1	6.0	4.3	5.1
22 students.....	5.2	6.8	4.6	8.1	4.9	7.3	6.2	8.5	7.6	6.5	6.5	7.3	7.0	6.9	7.0
23 students.....	5.4	5.2	7.8	13.0	6.7	7.5	7.5	6.3	8.4	10.2	10.4	8.8	8.8	11.8	10.3
13 students.....	12.1	9.2	12.7	13.8	22.8	13.1	14.0	14.6	10.7	12.4	18.4	14.1	19.1	15.8	17.5
7 instructors....	7.7	8.6	8.6	12.6	9.1	8.6	9.2	8.3	11.1	9.7	12.6	10.4	6.7	9.0	8.3

tion of teachers and students and the distinct influence of the institutional passing grade (70 per cent. at Illinois) in restricting the range within which one "feels" he can grade a given product. Students, when marking without the aid of the Scale, show three times as much mean variation as when marking with it (15 per cent. to 5 per cent.)

5. In grading samples at the 85-100 per cent. end of the Scale both instructors and students show no larger mean variations in marking without the Scale than in marking with it. In grading samples between 60-70 per cent. without the Scale the students show twice as much mean variation as with it, and instructors show one-third again as large a mean variation as with it. In grading samples below 60 per cent. both show nearly twice as large mean variations without the Scale as with it.

6. Students who have been trained in drawing and lettering, but who have never used the Scale, show nearly twice as large a mean variation in grading samples below 70 per cent. without the Scale, and half again as large a mean variation with samples ranging from 70 to 80 per cent., as students trained in use of the Scale and grading with it.

7. Students who have had a few weeks' training in the use of the Scale, when grading samples above 75 per cent. without the aid of the Scale, show mean variations practically identical with those of students grading the same samples with the aid of the Scale. With samples below 60 per cent. the mean variations of the students grading without the Scale are larger. *Students trained in the use of the Scale when grading without it show a smaller variation at the high end of the Scale than those not trained in the use of it, and show a variation only half as large at the middle and low end of the Scale.*

C. Comparative Practice Curves of Classes in Lettering, 1913 *and* 1914.

All students in the 1913 and 1914 classes in lettering taught by the writer have been arranged in groups as determined by the efficiency of their initial lettering product (the average of their first week's work). This division gives us four groups of students as follows: Group 1, initial product above 70 per

cent.; group 2, initial product 60 to 70 per cent.; group 3, 50 to 60 per cent.; group 4, below 50 per cent. The practice curves obtained from the average grades given the samples of each of these four groups in the two years are plotted in Diagrams 1 and 2. Examination of these curves and the detailed data shows that all groups of the 1914 class, using the Scale and the improved method, maintain a higher efficiency during each of the first seven weeks than do the corresponding groups of the 1913 class. The shape of the time curves for the two classes will be better understood if it is stated that the time was consciously held at a uniform level during the seven weeks of the 1914 work, whereas with the same work in 1913 the class was allowed to run down the time curve as succeeding weeks went on. The increase in efficiency in 1914 over 1913 has come with almost no individual instruction from instructor to student. Constant comparison of samples with the Scale is developing in the student a greater precision in analyzing the faults in his own technique and functions as a spur to raise the quality of his own product. The detailed argument concerning this phase of the work will be found in a monograph on the "Practice Curve in Free Hand Lettering" shortly to be published.

DIAGRAM 1.

Progress of thirty-one students in an average college class. Curves show average grades for groups of varying initial ability during a semester of fifteen weeks.

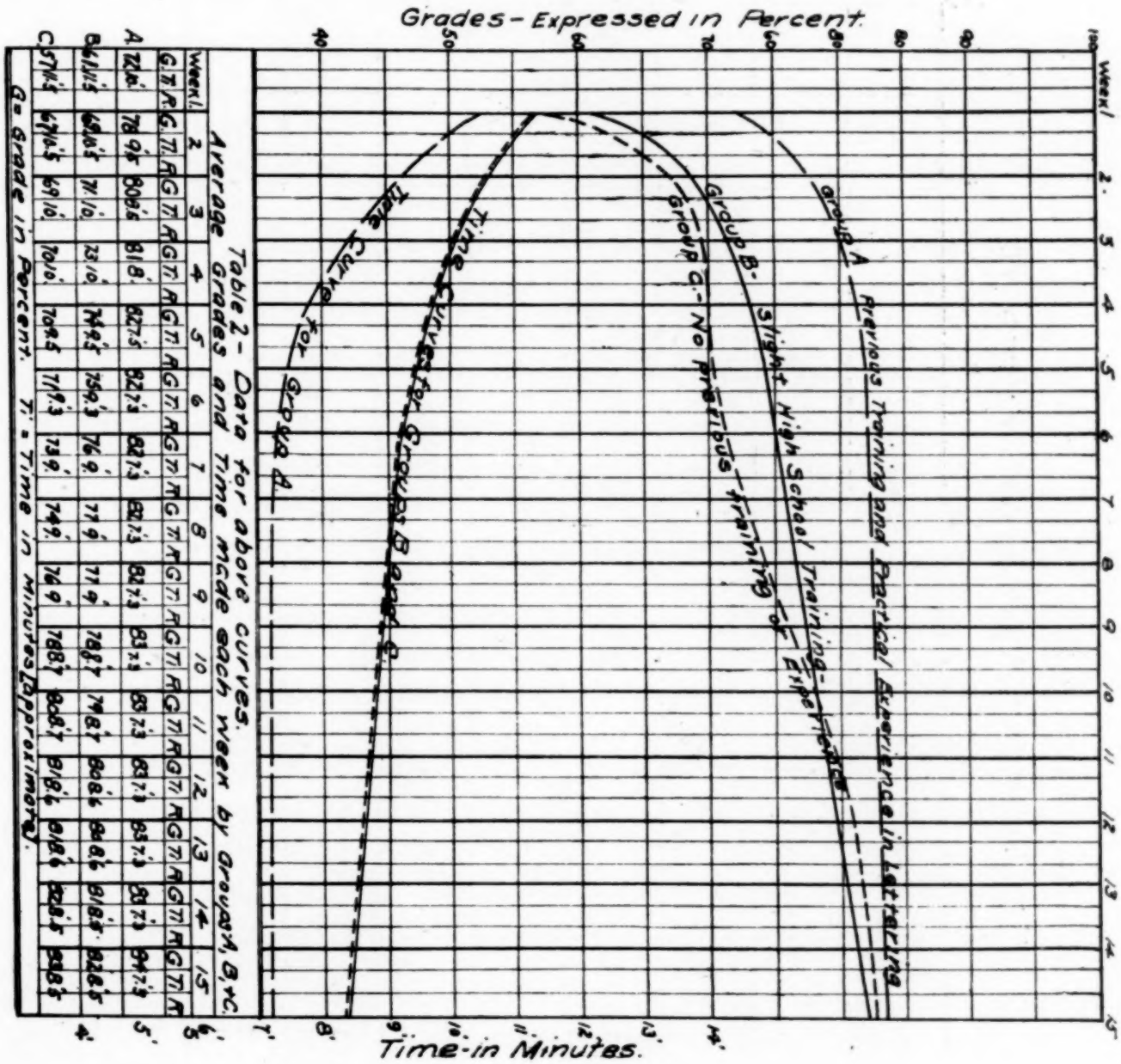

Grades - Expressed in Percent.
Time in Minutes.
Week
Group A — Averages Training and Practical Experience in Lettering
Group B - straight High School Training
Group C - No previous training
Time Curve for Group A
Time Curve for Group B
Time Curve for Group C

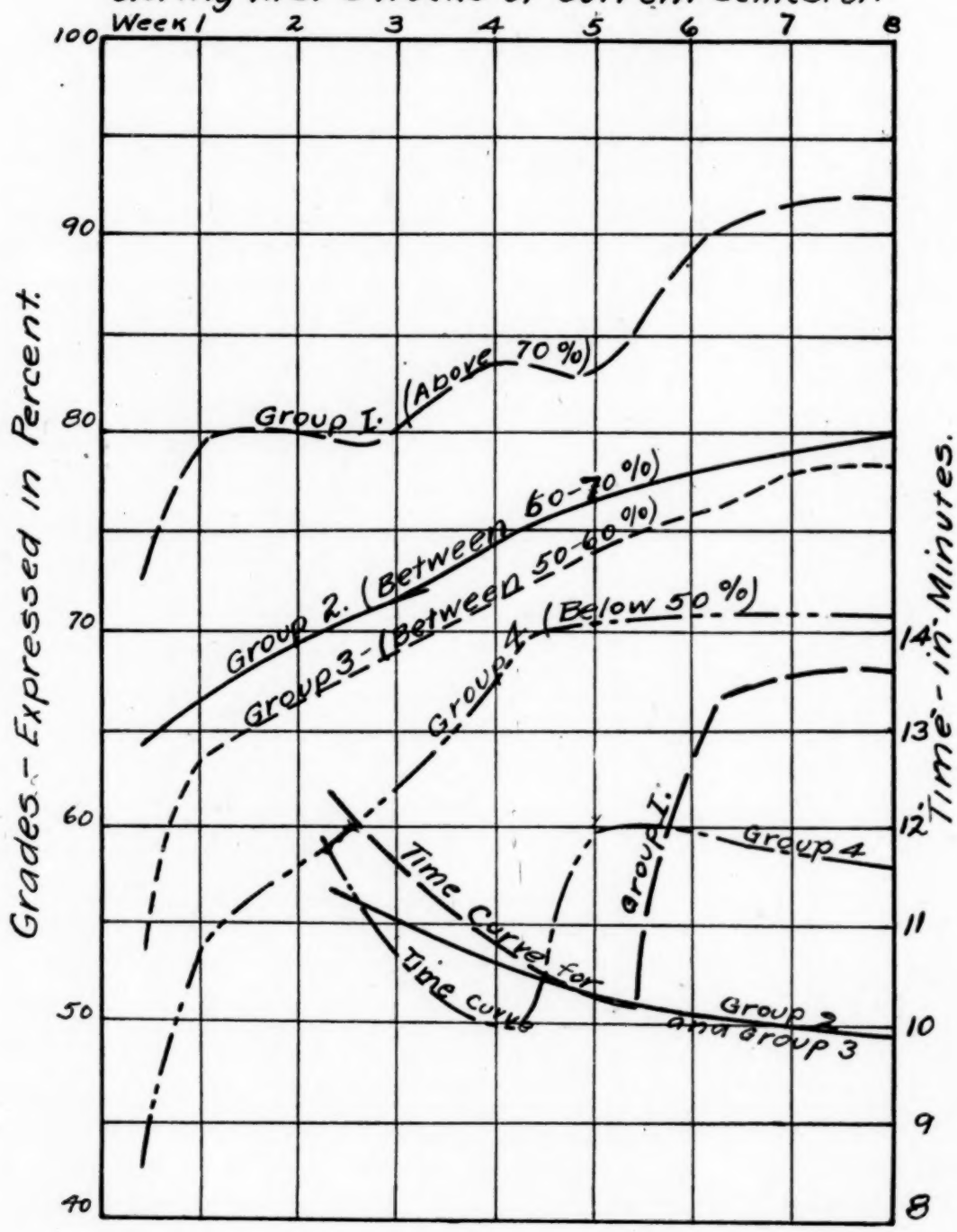
Table 2 - Data for above curves.
Average Grades and Time made each week by Groups A, B, & C.

	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		G.	T.	R. G.	T.	A G	T.	A G	T.	A G	T.	A G	T.	A G	T.	A G	T.	A G	T.	A G	T.	A G	T.	A G	T.	A G	T.	A G	T.
A		72%	1'	78%	9'	80%	8'	81%	8'	82%	7'	83%	7'	83%	7'	83%	7'	83%	7'	84%	7'	84%	7'	84%	7'	84%	7'	84%	7'
B		61%	13'	68%	10'	71%	10'	73%	10'	74%	9'	75%	9'	76%	9'	77%	9'	77%	9'	78%	9'	78%	9'	79%	9'	79%	9'	80%	9'
C		57%	13'	67%	13'	69%	10'	70%	10'	70%	9'	71%	9'	73%	9'	74%	9'	76%	9'	76%	9'	77%	9'	78%	9'	78%	9'	79%	9'

G = Grade in Percent. T. = Time in Minutes (approximate).

Diagram 2.

Progress of 37 students in an average college class. Curves show average grades for four groups of varying initial ability during first 8 weeks of current semester.



THE BINET TESTS APPLIED TO INDIVIDUALS OVER TWELVE YEARS OF AGE.

ALICE C. HINCKLEY, M.A.
Columbia University,
New York Clearing-House for Mental Defectives.

This study is based upon two hundred cases, thirteen years old and over, taken in order of admission to the New York Clearing-house for Mental Defectives, New York Post-graduate School of Medicine. The Goddard Revision of the Binet Tests—a copy of which is embodied in this report—was used, and his technique followed as closely as is possible without the use of a stop watch and a recorder. The tests were applied by three graduate students of the Department of Experimental Psychology of Columbia University, who had had previous experience in applying these and other tests.

The distribution, according to chronological age, of the two hundred cases, is shown graphically in Figure 1. The sudden drop at the sixteenth year and the irregularity in the more mature years is without pscyhological significance, being due to sociological conditions at the clinic. Mature defectives are less likely to be discovered by social workers or brought in by relatives. Many mature patients who attend the clinic for neurological treatment are not given the mental examination; and it is readily conceivable that many persons over fifteen years of age, though of nine, ten or eleven mental age, may be engaged in minor occupations and their feeble-mindedness thus escape notice. The distribution for mental age is seen in Figure 2. Its most noticeable feature is the depression in the ninth year, the cause for which will be noticed later in the examination of the relative difficulty of the individual questions. Figures 3, 4, 5, 6, give the distribution of boys and girls separately. That for the boys follows more closely the outline of the combined distribution except that in the chronological age the drop comes in the fifteenth year instead of the sixteenth; but, as stated before, this is due to a sociological rather than a psychological condition.

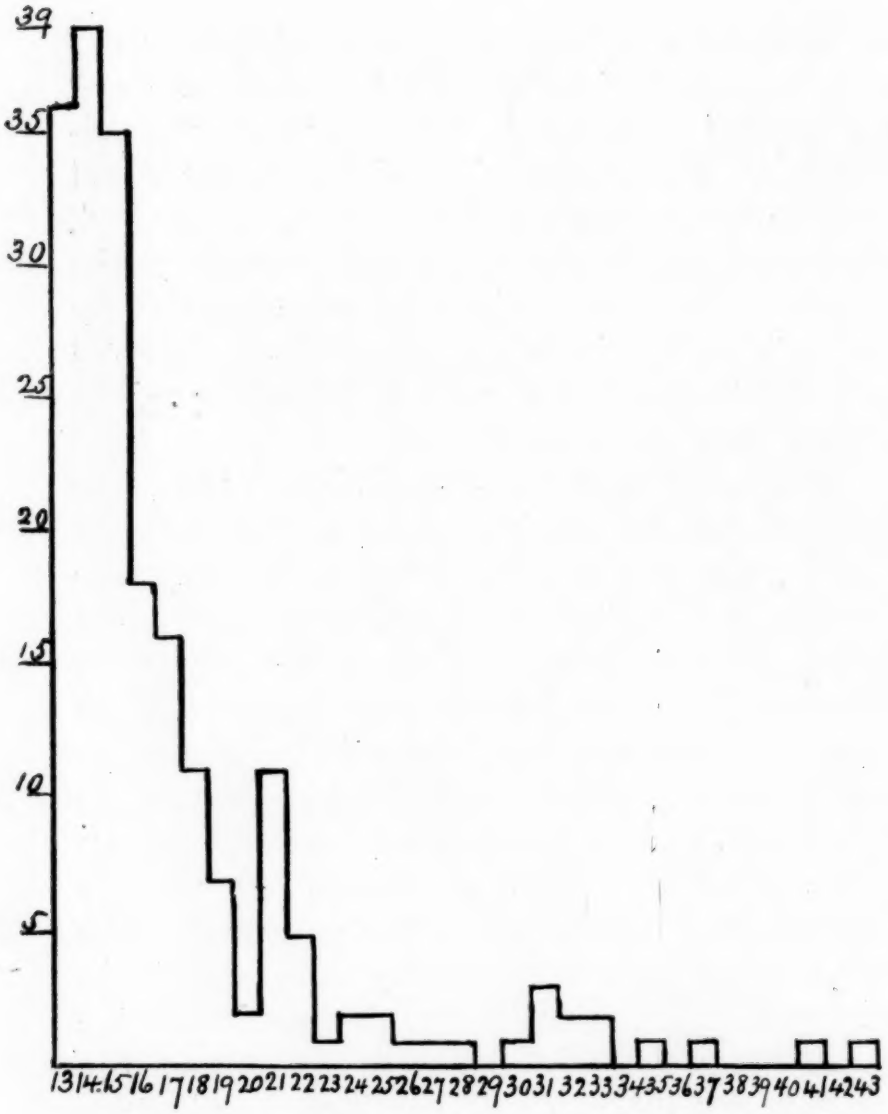


Figure 1. Chronological age of the 200 cases — both sexes — 13 yrs. to 43. Vertical figures show no. of cases.

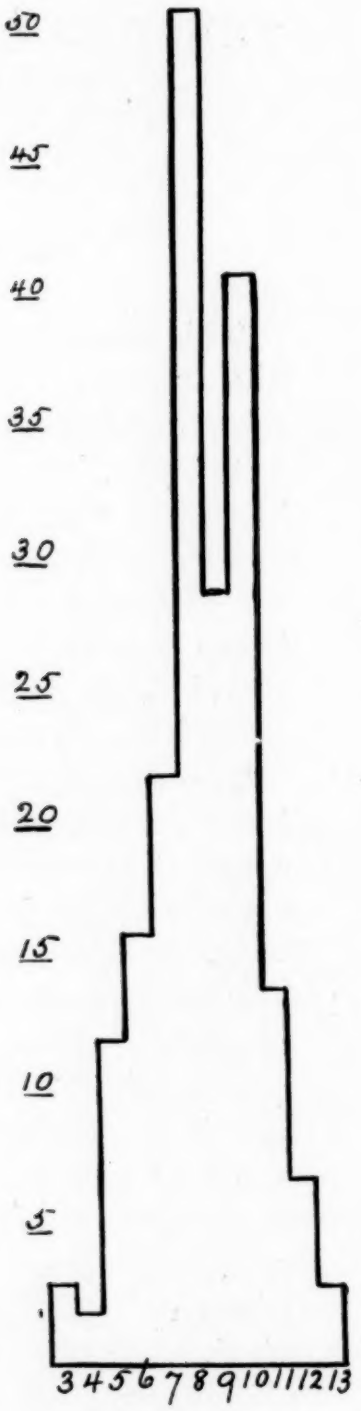


Figure 2. Mental age of 200 cases, 3 to 13.

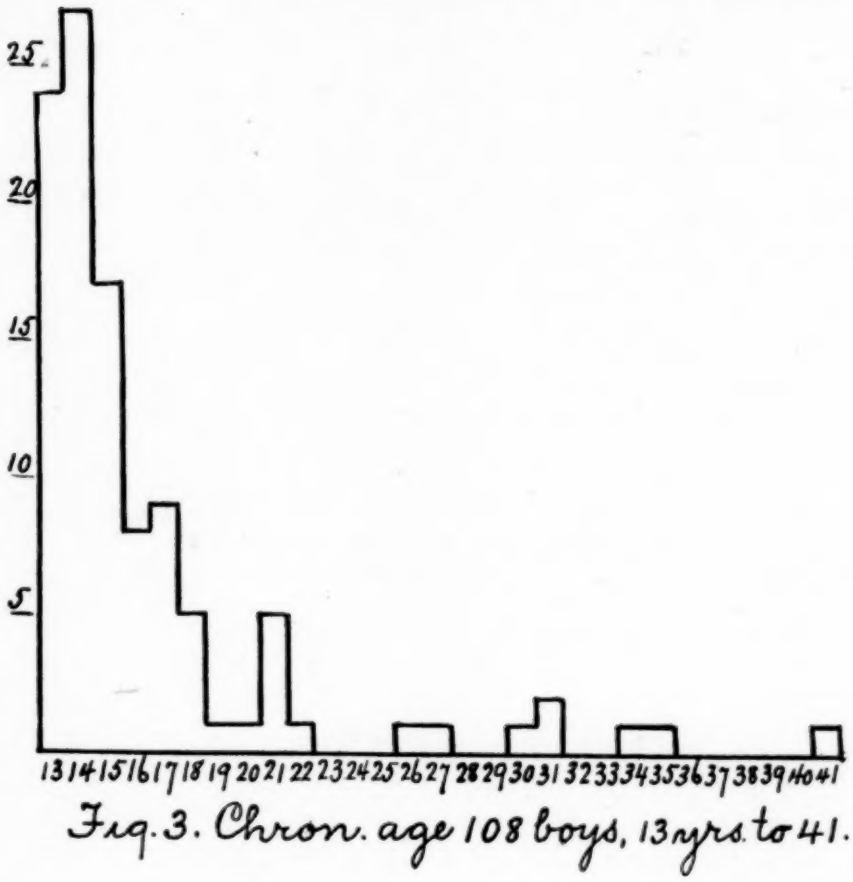
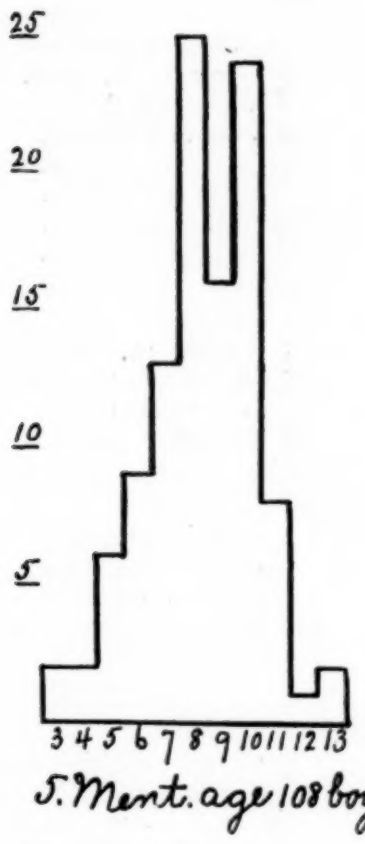


Fig. 3. Chron. age 108 boys, 13 yrs. to 41.



5. Ment. age 108 boys.

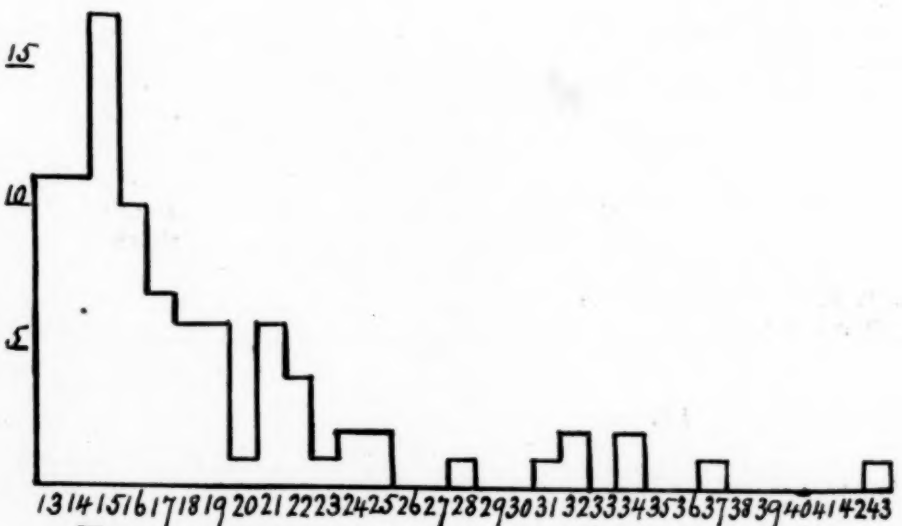
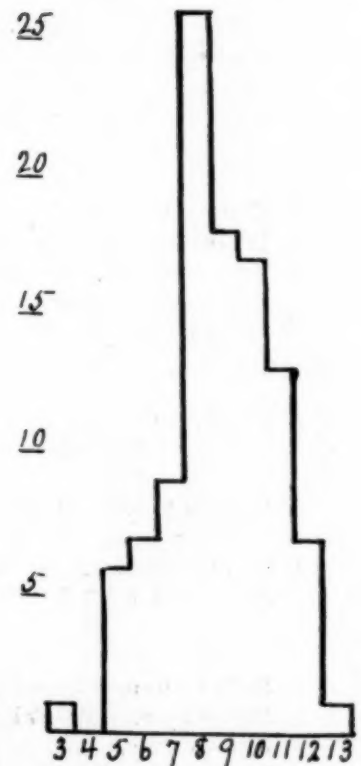


Fig. 4. Chron. age 92 girls, 13 yrs. to 43.



6. Ment. age 92 girls.

III.

1 Points to nose, eyes, mouth.
2 Repeats, "It rains. I am hungry."
3 Repeats 7 2.
4 Sees in Picture 1.
2.
3.
4.
5.

IV.

1 Knows sex, boy or girl (girl or boy).
2 Recognizes key, knife, penny.
3 Repeats 7 4 8.
4 Compares lines.

V.

1 Compares 3 and 12 grams. 6 and 15 grams.
2 Copies square (over).
3 Repeats, "His name is John. He is a very good boy."
4 Counts four pennies.
5 "Patience."

VI.

1 Morning or aftternoon (afternoon or morning).
2 Defines fork

table	horse
chair	mama

3 Puts key on chair; shuts door; brings box.
4 Shows R. Hand. L. Ear.
5 Chooses prettier? 1 & 2. 4 & 3. 5 & 6.

VII.

1 Counts 13 pennies.
2 Describes pictures. (Sec. III, 4.)
3 Sees picture lacks eyes, nose, mouth, arms.
4 Can copy diamond (over).
5 Recognizes red, blue, green, yellow. (Time 6″.)

VIII.

1 Compares (Time 20″)

Butterfly	Wood	Paper
Fly	Glass	Cloth

2 Counts backward 20-1.
3 Repeats days. M. T. W. T. F. S. S. (Time 10″.)
4 Counts stamps. 111222. (Time 10″.)
5 Repeats 4 7 3 9 5.

IX.

1 Makes change 20c.—4c.
2 Definitions. (See VI, 2.)
3 Knows date.
4 Months. J. F. M. A. M. J. J. A. S. O. N. D. (Time 15″.)
5 Arranges weights. (2 correct.) (1′ each.)
1. 2. 3.

X.

1 Money. 1c. 5c. 10c. 25c. 50c. $1. $2. $5. $10.
2 Copies design.
3 Repeats 8 5 4 7 2 6. 2 7 4 6 8 1. 9 4 1 7 3 8.
4 Comprehends.

(1st Series time 20″.) (2 out of 3.)	(2nd Series time 20″.) (3 out of 5.)
1.	1.
2.	2.
3.	3.
	4.
	5.

5 Sentence: Philadelphia, Money, River. (Time 1′.)

XI.

1 Sees absurdity. (3 out of 5.) (Time 2′.)
a. Unfortunate painter.
b. Three brothers.
c. Locked in room.
d. R. R. accident.
e. Suicide.
2 Sentence: Philadelphia, Money, River. (See X, 5.)
3 Gives 60 words in three minutes. (over).
4 Rhymes (time 1′ each). (3 Rhymes.)

day	mill
spring	door

5 Puts dissected sentences together. (Time 1′ each.)
a. We started at an early hour for the park.
b. I have asked the teacher to correct my paper.
c. A good dog defends his master bravely.

XII.

1 Repeats 2 9 6 4 3 7 5. 9 2 8 5 1 6 4. 1 7 9 5 8 4 7.
2 Defines Charity.
Justice.
Goodness.
3 Repeat, "Children, it is necessary to work very hard for a living. You must go every morning to your school."
"The other day I saw in the street a pretty young dog. Little Maurice has got spots on his new apron."
"Ernest is praised very often for his good conduct. I bought at the store a beautiful doll for my little sister."
"There occurred on that night a frightful tempest with lightning. My comrade has taken cold. He has fever and coughs very much."
4 Resists suggestion. (Lines.)
5 Problems: (a) Hanging from limb. (b) Neighbors visitors.

XV.

1 Interprets picture.
2 Change clock hands. 6.20 = 2.56 =
3 Code. COME QUICKLY.
4 Opposites.

1 good	3 quick	5 big	7 white	9 happy
2 outside	4 tall	6 loud	8 light	10 false

The purpose here is to study the results of the Binet Tests as applied to mental defectives over 12. It was suggested by the fact that whereas the younger feeble-minded children reached the limit of their possible response very soon after the age series in which all questions were correctly answered—usually one or two succeeding years, with a correct answer here and there—many of the older ones, proportionately, began on a lower series and gave straggling returns over a wide range of series—sometimes extending over the questions for six or eight years. In some instances where complete or approximate failure was shown in earlier years, they have succeeded with the questions of later series. The limit of the range for each subject is shown by correct answers for all the questions of one age series at the beginning, and failures for all the questions of one age series at the end. In Table I this is designated as the limiting number of series. It will be noticed that the 10 subjects who were obliged to go back to the third-year questions, in order to get a positive series, ranged in series from 3 to 10 and in chronological age from 13 to 35, while their mental range was from 2.8 to 6.2 years. The 33 subjects whose range of series was 7 to 14 were from 13 to 41 years old with a mental range from 7 to 11 years. If the averages are taken the results are less spectacular: the average mental age shows a fairly regular increase, the advancement being conditioned on the control of the material; the average chronological age is irregular and with the average deviation and probable error as shown precludes any deduction of value. The table is of interest as showing how the tests go: it illustrates the fact that a wide range of chronological age had to use questions covering a wide range of series; and it shows that the few who began at a later series had to be younger, and that they reached a higher mental average. It also suggests a further inquiry as to whether the older subjects are more deficient than the younger, and whether the tests are a reliable scale for them.

The distribution for boys and girls for each chronological age is given in Figures 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; and for the 18-to-43-year group in Figures 17 and 18. This is shown again in Figures 19, 20, 21, 22, where the single years are com-

TABLE I.

Limiting No. of Series.

R. of Series.	Ave. of Series.	R. of Chr. Age.	Ave. Age.	A. D.	P. E.	R. of Ment.	Ave. Ment.	A. D.	P. E.	Ment. Coef.	No. Cases.
3-10	3- 8	13-35	18.	4.8	1.3	2.8- 6.2	4.4	.9	.26	.24	10
4-13	4- 9	13-31	17.	3,	.6	5. - 8.4	6.3	.7	.14	.37	18
5-14	5-11	13-43	20.	7.	1.2	6. - 9.6	7.3	.7	.12	.36	22
6-14	6-11	13-33	17.	3.	.5	6.6- 9.6	8.	.5	.08	.47	30
7-14	7-11	13-41	18.	3.6	.5	7. -11.	8.9	.75	.11	.49	33
8-14	8-12	13-25	17.	2.8	.3	8.6-12.4	10.	.7	.08	.59	51
9-14	9-13	13-28	17.	3.7	.67	9.4-12.4	10.9	.6	.11	.63	21
10-14	10-13	13-21	15.5	1.8	.5	10.4-12.	11.2	.5	.14	.72	10
11-14	....	14-21	....	...	...	12.2-13.4	....	..	...	...	2
12-14	....	13-23	....	...	...	12.6-12.4	....	..	...	...	2
15-	....	21-	....	...	...	15.	....	..	...	...	1
											200

bined in two groups—the 13-14 and the 15-17. The final combination into three groups is seen in Figures 23, 24 and 25; and these three groups, 13-14, 15-17, and 18-43, as giving the most even division of the 200 cases, are used as the basis of comparison. Of those who reached nine years and over, the first group contains 46; the second, 39; the third, 31; 10 years and over, the first group, 36; the second, 23; the third, 22.

TABLE II.

	Boys.				Girls.			
Chronological Age.	No.	M. Age. Ave.	A. D.	P. E.	P. E.	A. D.	M. Age. Ave.	No.
1. 13.....	25	9.0	1.6	.27	.4	1.6	8.7	11
14.....	28	9.0	1.5	.23	.48	1.8	9.3	11
2. 15.....	18	8.0	1.6	.32	.24	1.2	8.8	17
16.....	8	8.8	2.2	.66	.38	1.4	9.5	10
17.....	9	8.3	1.2	.33	.28	1.1	9.0	7
3. 18–43..	20	8.3	1.4	.26	.27	1.8	8.8	35
Group								
1.....	53	9.0	1.5	.17	.30	1.7	9.0	22
2.....	35	8.3	1.7	.24	.17	1.2	9.0	34
3.....	20	8.3	1.4	.26	.27	1.8	8.8	33

Table II gives for boys and girls separately the average mental age, average deviation and probable error for each chronological age up to 18, and then for each of the three groups. If there is any increase in defectiveness with advanc-

ing maturity, it should appear in the comparison of these three groups. The average mental age of boys of the first group is nine years and of the second and third groups 8.3 years. In comparing the first and second we find the probable error of their difference, .7, to be .28; the probable error of the difference between the first and third is .31; and the probable error of the difference between the second and third is .34. So that, after all due allowance for deviation and error, there remains with the first group (13-14) an advantage of .42 over the second group, and of .39 over the third group. The case of the girls is not so plain, the average mental age of the first and second groups being nine, and of the third, 8.8. The probable error of the difference between the first and second groups is .37; between the first and third groups, .40; and between the second and third groups, .32.

The next question suggested by this material is whether the Binet tests give a steadily increasing scale, and hence provide a measure of mental ability, over 12 years of age. Table III gives the percentage of error of the three groups for each mental age series. The age series increase everywhere except from three to four in difficulty as you go from lower to higher series, but not uniformly. That is, the fifth year is harder than the fourth, the sixth than the fifth, and so on; but instead of advancing regularly in difficulty there are decided jumps, noticeably from the seventh to the eighth, from the eighth to the ninth, and from the tenth to the eleventh. Of these jumps, the first is most pronounced in the 13-14 group; the second in the 15-17 group; and the third is equally prominent in the three groups. The third and fourth-year series are equally easy for adults.

We are now ready to consider whether the four or five single tests included by Binet under each year are of equal difficulty as applied to adults. The distribution of errors for each question for the 200 cases is shown graphically in Figure 26. In the main, there is indicated a general advance in difficulty, but it is confused with a remarkable irregularity and sawing back and forth from question to question even greater than has appeared in our study of their relative difficulty from one age series to another. A better chance to get at this situation is

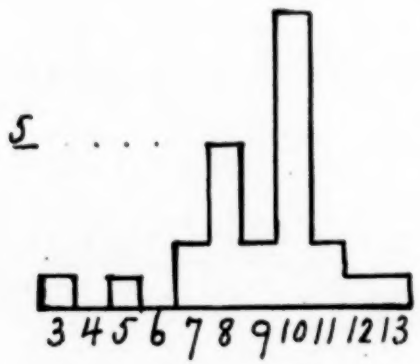


Fig. 7. Ment. age
25 boys 13 yrs. old.

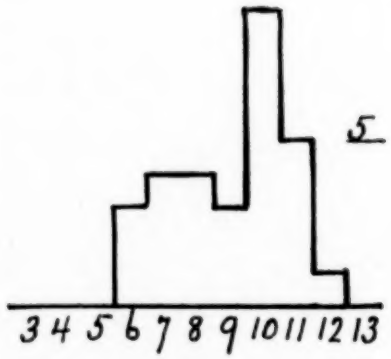


Fig. 9. Ment. age
28 boys 14 yrs. old.

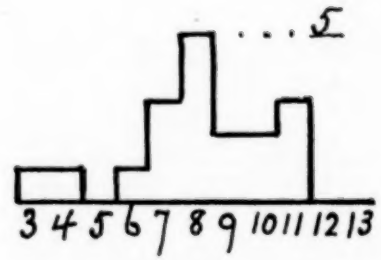


Fig. 11. Ment. age
18 boys 15 yrs. old.

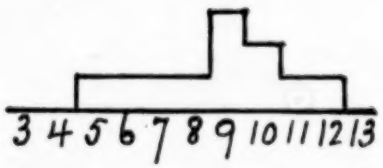


Fig. 8. Ment. age
11 girls 13 yrs. old.

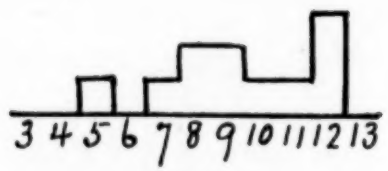


Fig. 10. Ment. age
11 girls 14 yrs. old.

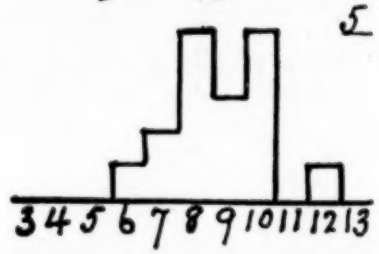


Fig. 12. Ment. age
17 girls 15 yrs. old.

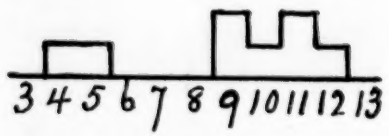


Fig. 13. Ment. age
8 boys 16 yrs. old.

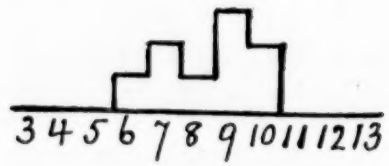


Fig. 15. Ment. age
9 boys 17 yrs. old.

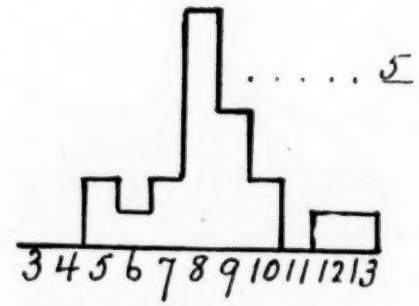


Fig. 17. Ment. age
20 boys 18 to 43 yrs.

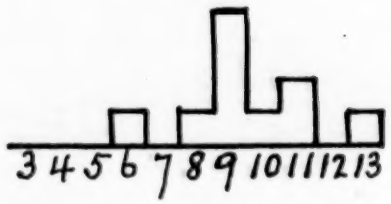


Fig. 14. Ment. age
10 girls 16 yrs. old.

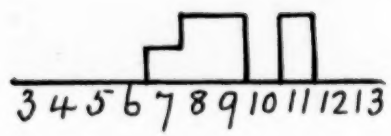


Fig. 16. Ment. age
7 girls 17 yrs. old.

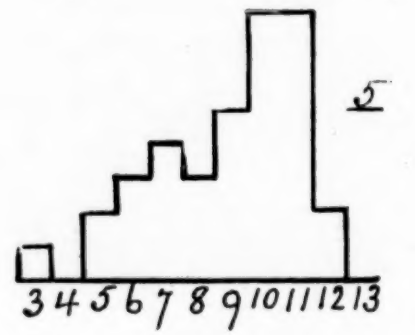


Fig. 18. Ment. age
36 girls 18 to 43 yrs.

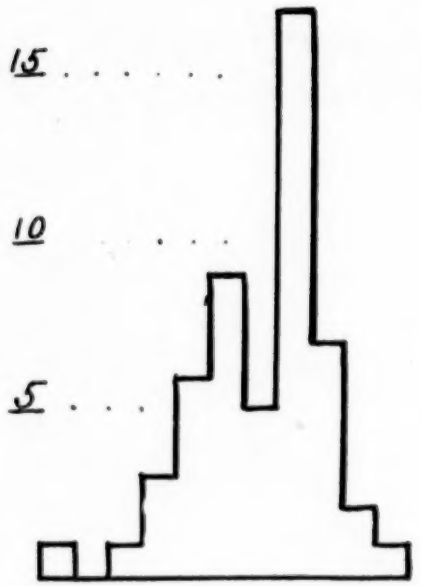


Fig. 19. Ment. Age
53 boys 13 and 14 yrs.

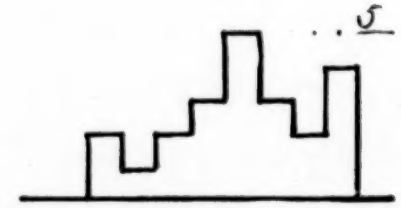


Fig. 20. Ment. age
22 girls 13 and 14 yrs.

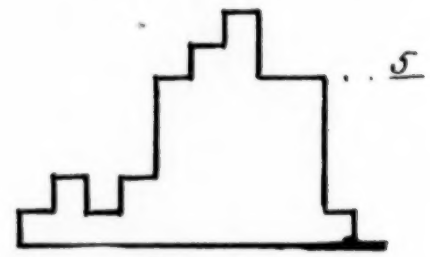


Fig. 21. Ment. age
35 boys 15, 16, 17 yrs.

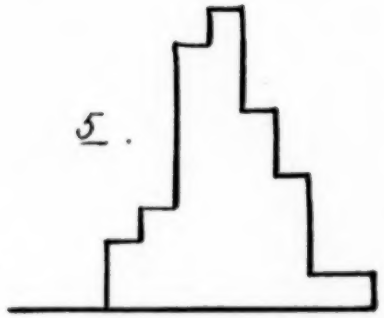
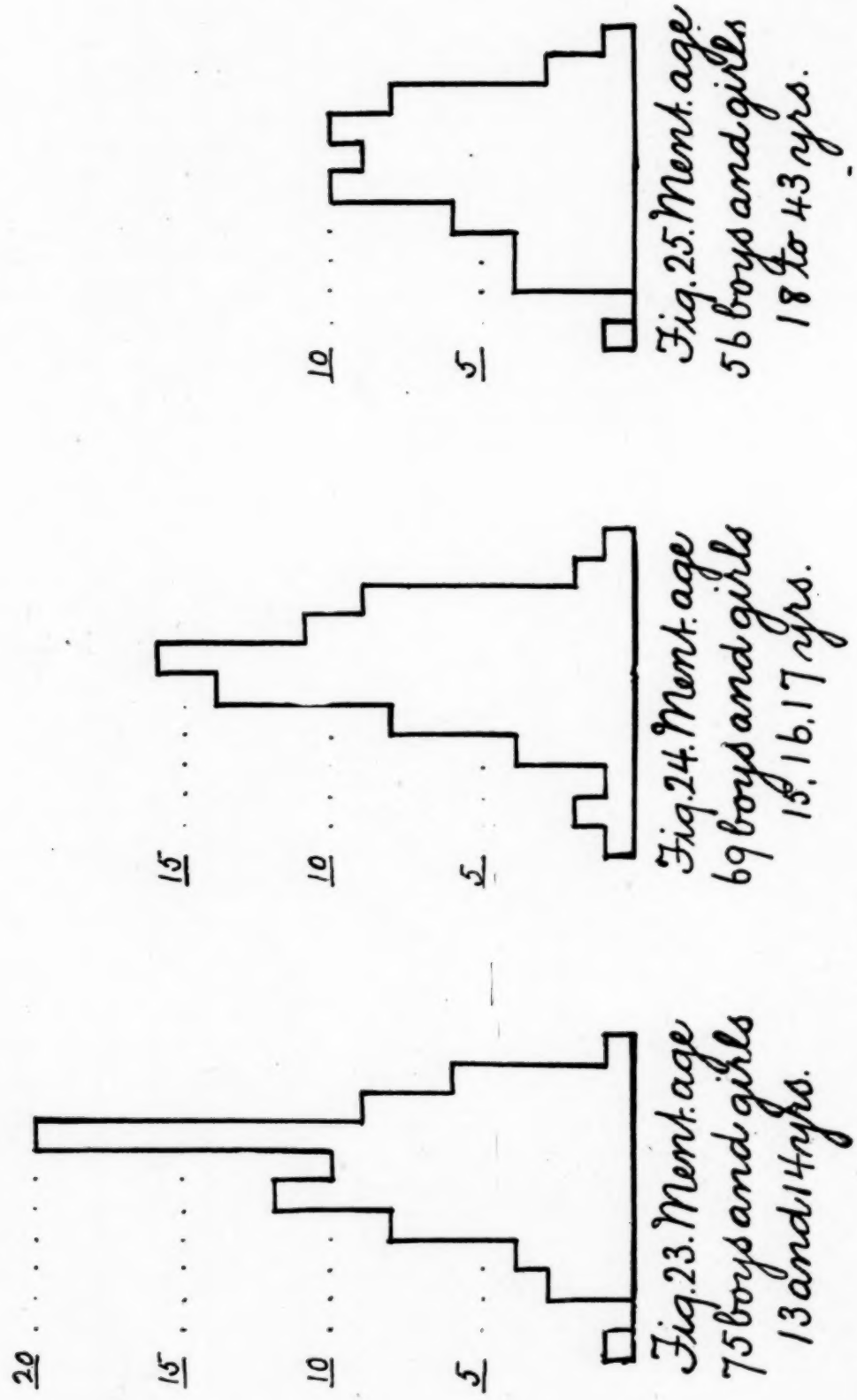


Fig. 22. Ment. age
34 girls 15, 16, 17 yrs.



afforded by Table III, which gives the percentage of error for each question and makes the discrepancies between questions in each age-series apparent. The results for the fifth year

vary from 4 to 8 per cent. of error; the sixth year from 7 to 16 per cent.; the seventh year, from 5 to 30 per cent.; the eighth year from 15 to 36 per cent.; the ninth year, from 30 to 66 per cent.; the tenth year, from 23 to 77 per cent., and so on. These are rather striking differences in questions that have been standardized on the basis of at least 75 per cent. of correct answers for each question with large numbers of children of the specified age. Not only are discrepancies found within a given age-series, but there are cases where later questions

TABLE III.

Per Cent. of Errors for Each Question.

No. Cases.	Year.	1	2	3	4	5
3	3	0	2	0	2	..
2	4	1	0	2	2	..
12	5	8	6	7	4	6
16	6	11	7	16	10	9
22	7	5	15	16	30	12
51	8	36	29	15	34	33
29	9	44	66	40	30	63
41	10	23	77	51	65	65
14	11	80	74	62	68	93
10	12	81	87	95	80	86
..	15	88	94	96	79	..

are easier than earlier ones. The first question in the seventh year, for example, which requires the counting of 13 pennies, has a lower per cent. of error than any question in the sixth year, and than any in the fifth year except the fourth question—to count four pennies. The third question in the eighth year—repeating the days of the week—is another instance; it being easier than three of the seventh-year questions and than one of the sixth year. The same is true of the fourth question in the ninth year—naming the months—and of the first question of the tenth year—recognition of the different denominations of money—whose 23 per cent. of error proves it to be easier than all of the ninth-year questions, all of the eighth-year questions except the third—naming the days—and than one of the seventh-year questions. From the seventh year on, with the exception of the twelfth year, every year has at least one question that would seem to be as much as two years out of place. The fourth question in the fifteenth year—opposites—seems to rank with the eleven-year questions. Coming at it the other way around and considering the misplacement

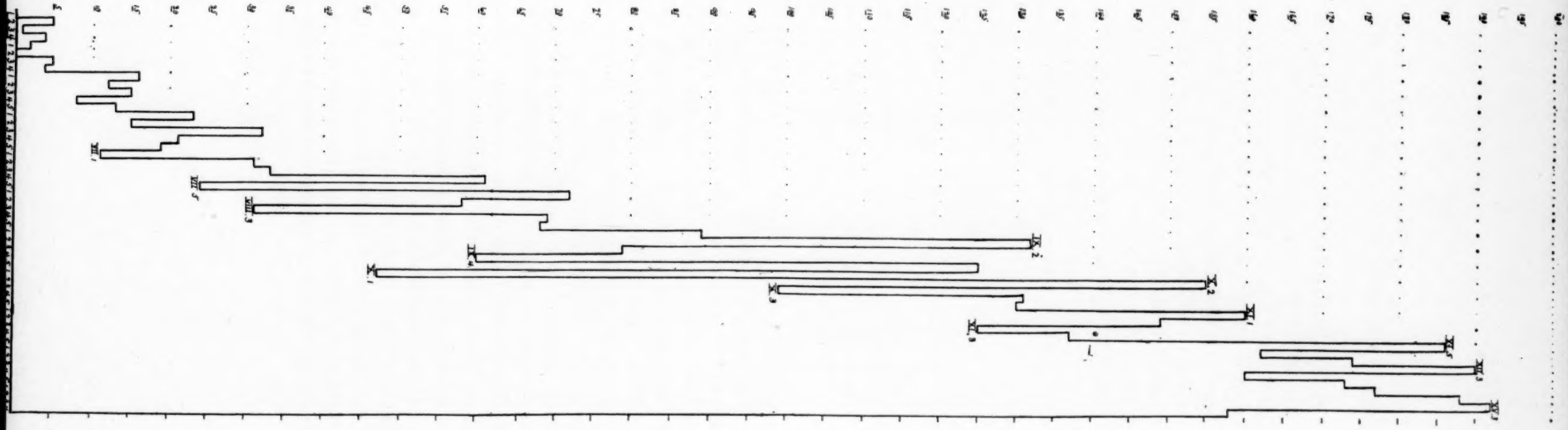


FIGURE 26.—Number of errors for all questions. 200 subjects, ages 13 to 43 years, inclusive.

of the difficult questions, it would appear that the fifth question of the eleventh-year series—putting dissected sentences together—with its 93 per cent. of error; the third question of the twelfth-year series—repeating long sentence—with 95 per cent. of error; and the second and third questions of the fifteenth-year series—changing the hands of the clock and the using of code—with 94 and 96 per cent. of error, respectively, would have no place at all of value for this particular group of individuals.

The evidence would seem to point to the conclusion: (a) that there is an increase of feeble-mindedness to some extent with advancing maturity over 12 years of age, especially for boys; (b) that the Binet tests do not give a scale of steadily increasing difficulty for adults; and (c) that the questions for any one year are not of equal difficulty for adults. How to account for this is another matter and necessitates some speculation.

The increase of feeble-mindedness with advancing age beyond 12, with the limiting number of age-series extending over a range of six or eight years, does not agree with Goddard's theory that a 40-year-old boy of eight can not only do what one eight-year-old boy can do, but what a great many eight-year-old boys can do. This evidence points to his being able to do a little of what a six, seven, eight, nine and ten-year-old boy can do. The increase in defectiveness may be due to the close retirement in which mature defectives are kept at home, without developmental activity or stimulation for what mentality they possess and so it fades out from disuse; or it may be due to physiological degeneracy, as in senility. The activity of social workers under the stimulus of recent agitation on this subject, connected with the establishment of The Clearing-house for Mental Defectives, where they may be examined and assigned to custodial care if necessary, has brought many of these defectives into notice who otherwise would have completed their existence in the seclusion of their homes. The increasing feeble-mindedness of boys in excess of that of girls is in accord with the conclusion that males show greater variability, and this is the negative end of the curve of distribution.

The irregularity in the increase in difficulty of the Binet

tests as here shown is probably due to the peculiarity of the adult reaction to them, as stated before. A sudden acquisition of difficulty is shown in the eight-year series, with such requirements as stating differences between familiar things, counting backward, counting and giving value of stamps, and repeating five numbers. Some interference may be due to the unusualness of being asked, for no apparent reason, to do these unfamiliar performances with familiar things, and some to their inability to adapt themselves to a new situation and follow directions as a young child does. What mentality they have may be centered on something else—whether they are doing well, for instance, or making a good appearance; or they are wholly engrossed with self-satisfaction at their supposed achievement—rather than on the disconnected requirements presented.

The irregularity in the difficulty of the individual questions within any one year-series or from one year-series to another may probably be accounted for in the same way. The easy ones—as counting four pennies, V, 4; defining fork, table, chair, horse, mama, VI, 2; counting 13 pennies, VII, 1; repeating days of week, VIII, 3; repeating months, IX, 4; recognizing different denominations of money, X, 1; giving 60 words in three minutes, XI, 3; telling which line is longer (in six pairs), XII, 4; opposites of simple words, XV, 4—are more or less familiar and do not take them out of frequented paths of experience. But when they are asked to choose the heavier of two very small weights, V, 1; to copy a diamond, VII, 4; to compare two things, VIII, 1; to give definitions (better than use) for fork, table, chair, horse, mama, IX, 2; to arrange five very small weights in order, IX, 5; to draw a complicated design (two figures) from memory, X, 2; to see the absurdity in five stories in two minutes, XI, 1; to put dissected sentences together, XI, 5; to repeat a sentence of 26 or more syllables, XII, 3; in imagination to change the hands of a clock and tell the time, XV, 2; in a few minutes to learn a code sufficiently to write a short message from memory, XV, 3; some confusion and interference may well be expected to befog their mental atmosphere. Mental habits and even stupidity become more fixed with time, and the Binet tests as now arranged do not allow for overcoming the inertia of maturity.

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EDITORIALS.

INCREASES IN ENROLLMENT AS CRITERIA OF SCHOOL EFFICIENCY.

Critics of public education are wont to lay large emphasis upon statistics of school attendance, and especially upon the relatively smaller enrollments in the upper grades and the high schools as compared with the enrollments in the lower grades. The inference commonly drawn is that the school programs are not adjusted to the needs of adolescent boys and girls. This maladjustment may be a fact (beyond doubt a more adequate adjustment is both necessary and feasible), but one may easily turn the statistics into an apparent proof of the school's complete failure when, as a matter of fact, they show convincingly that, in spite of maladjustments and other evils, public education is fairly successful if success is to be measured by the enrollment standard.

Perhaps the most stupid mistake is to make crude comparisons of figures without stopping to inquire what they mean. Thus when one finds that the high-school enrollment is only 6.5 per cent. of the elementary-school enrollment, one may jump to the conclusion that the high schools receive only 6.5 per cent. of those entering the elementary school, and consequently that 93 per cent. of those entering are eliminated during the first eight years. The absurdity of this

inference is apparent when we remember that the high-school course is only four years in length (and in many communities less than four years), while the elementary course almost universally covers eight years; consequently we could never expect the high-school enrollment to be more than half the enrollment in the elementary schools. Beyond this, the growth of population must be taken into account, and this in the course of eight years (covering the time that lapses before a generation entering the first grade reaches the high school), is a factor of some magnitude.

But even good schoolmen, without the opportunist's craving to prove our educational system a gigantic failure, have committed another fallacy in comparing school enrollments at different age-levels without including in the comparison a reference to conditions in preceding decades. For example, Principal W. D. Lewis, in a very suggestive little book, *Democracy's High School,* just from the press, compares the enrollments in different years of the high-school course as follows: Out of 100 boys in the first year,

> "41 boys will not return the second year, 62 of the original 100 will not return the third, and 76 will not return the fourth. Of the 24 left, somewhere from 5 to 10 will go to college. Here, then, are the American Beauty roses, for which we have pinched off 90 to 95 buds."

In order to determine whether the figures given indicate a tendency toward *increased* elimination, the writer had the growth of the high schools in Illinois during a period of eight years computed by classes. Several facts were brought to light. In the first place, the high-school enrollment of Illinois has grown during that period 800 per cent.; the population has increased approximately 100 per cent.—in other words, the high schools have grown eight times as fast as the population. In the second place, the proportion of fourth-year pupils to third-year pupils has increased steadily, decade by decade; hence "elimination" has steadily declined. In the third place, during the past five years the growth of the third and fourth-year classes has been much more rapid proportionately than during any preceding five-year period. In the fourth place, the proportion of boys to girls in the high schools has increased steadily, and is still increasing. While the upper classes in the high chools are smaller than the lower classes, the chief reason is not elimination, *but the marvelous increase in the first-year classes.* The high-school enrollment in the country at large has increased approximately ten times as fast as the population in the last twenty-four years, and is

still growing at a rapid rate. So long as this growth continues one must expect absolutely more pupils in the first year than in the succeeding years, and the contrast of the first year with the fourth year, covering as it does three years of very rapid growth at the lower end, will be particularly misleading. When the upper classes of the high school approximate in numbers the lower classes, it will mean that the high school *has stopped increasing its enrollment proportionately to the population.* Mr. Lewis may be right in his contentions, but the inference that the reader draws from his figures does a marked injustice to those who have been responsible for the growth of the high schools during the past three decades.

THE APPARENT DECREASE IN SCHOOL ENROLLMENT.

Another comparison that has not yet been taken up by the critics may well be discounted against the time when they stumble across the statistics. The Report of the Commissioner of Education reveals some figures that, at first glance, are most disquieting. In many of the States the ratio of public-school enrollment to total population has declined steadily since 1870. In New York, for example, the enrollment in public schools in 1870-71 was 23.18 per cent. of the total population; in 1911-12, it was only 15.3 per cent. The decline has been progressive, each decade showing a lower proportion than the preceding. The same condition holds in certain other States, particularly in the States containing the large cities, but it is not so noticeable in States the population of which is still predominantly rural. Indeed, in some of the latter, especially in the South, the per cent. of enrollment to total population has increased significantly.

When one seeks for an explanation of this decline, a significant cause is found in the decrease in the size of the average family—and this, too, is more noticeable in the urban than in the rural population. This means that today in certain States there are actually fewer children in proportion to the total population than in 1870—and a decrease of one individual in the size of the average family will make a very large difference in the ratio of school population to total population.

This, however, does not satisfactorily explain another showing revealed by the Commissioner's tables, namely, that the public-school enrollment has decreased during this period not only in proportion

to the total population, but also *in proportion to the population of school age.* This, too, is largely limited to the thickly-populated States with large areas of urban territory. The explanation here is undoubtedly the relative increase in the parochial-school enrollment. The Roman Catholic parochial schools, for example, enroll upward of 1,500,000 children, or about *seven and one-half per cent. of the total school enrollment.* It is safe to say that this proportion has steadily increased since 1870, when it was practically negligible. This would much more than account for the decrease that the Commissioner's figures show, and the conclusion is forced home that, in spite of the smaller size of the average family, the total school enrollment, taking public and parochial schools together, has increased steadily, not only absolutely, but proportionately, both to the total population and to the population of school age. When we turn to the Census reports we find this inference abundantly confirmed for the decade 1900-1910. (Data are not available for previous decades.) More children were attending school in proportion to the population in 1910 than in 1900; and, not only this, but throughout the country there was a proportionate increase *in every age-group* in attendance upon the schools. The only exception is in one State—Nevada—and there the decrease was confined to one age-group. The Federal census, unlike the Commissioner's report, includes data from all types of schools.

To strive for the improvement and extension of educational facilities is a most laudable endeavor; but to charge that the present organization of the schools is a complete failure as shown by statistics of decreasing enrollment is a rank injustice. It would be refreshing to find a "reformer" who would start with the frank admission that those who preceded him had achieved through their struggles and efforts something besides failure. W. E. B.

A CORRECTION.

In the December number of the JOURNAL an error in making up the forms caused some confusion in Professor Thorndike's communications on page 597. Table I and the comment below it go with the first communication, and should be at the top of the page. The beginning of the second communication should be transposed to the lower half of the page.

In Professor Dearborn's review of Morton Prince's *The Unconscious,* page 600, line 8, the word "censure" should have been "venture."

PUBLICATIONS RECEIVED.

(Notice in this section does not preclude a more extended review.)

EARL BARNES *The Psychology of Childhood and Youth.* New York: B. W. Huebsch, 1914. Pp. 68. 50 cents.

This is an outline syllabus of thirty lectures with selected references for further reading at the end of each lecture. The object of the course is to "outline the results of the more recent individual and group studies on the physical, mental, moral, social, esthetic and religious life of childhood and youth." The outlines show that the author is conversant with recent developments in child psychology, and the ideas advanced are stimulating and suggestive.

EMMA MILLER BOLENIUS. *The Teaching of Oral Euglish.* Philadelphia: The J. B. Lippincott Co., 1914. Pp. xii, 214.

This book represents an effort to carry out the recommendations of the National Council of Teachers of English, and to put in concrete form the suggestions that have recently appeared in the *English Journal* relative to greater emphasis on oral English in the teaching of English composition. It attempts to apply the laboratory method to the development of facility in pupils' thinking and expression. It is constructed upon sound principles of child psychology.

LOUISE CREIGHTON. *The Social Disease and How to Fight It.* New York: Longmans, Green & Co., 1914. Pp. 87. 36 cents.

This book was written by an English woman, an ardent suffragist, to prepare the minds of the women of England for a thorough and searching study of the whole question of the social evil, and for the campaign of enlightenment which is to be waged when the findings of the Royal Commission on Venereal Diseases shall have been made public. The author argues that the origin of the whole group of social evils is to be found in the double standard of morality for men and women, and shows that the eradication of the double standard can only be brought about by a slow process of education in which the women will probably have to take the lead.

WILLIAM SILLIMAN FOSTER. *On the Perseverative Tendency.* Reprinted from the American Journal of Psychology, Vol. 25, No. 3, July, 1914. 393-426.

The term "perseverative tendency" has played a prominent part in recent discussions of the memory process—particularly those emanating from G. E. Müller and his pupils. The author shows that the term has been used in many different senses, and his experimental work raises a doubt as to the existence of such a tendency in the

sense of the spontaneous recurrence of experiences without associative connection.

OSCAR GERSON. *Instruction in the Grades. Values and Methods.* New York: Hinds, Noble & Eldredge, 1914. Pp. xii, 273. $1.25.

A series of plain, practical, common-sense talks on the teaching of reading, composition, spelling, grammar, arithmetic, geography, history and physiology. The author's reflections are expressed with a certain charm and fluency, but his psychology is of the most formal type, and there is not a trace of the influence of modern experimental studies in the teaching of school subjects.

FRANK L. GLYNN. *Some Trade Schools in Europe.* Bulletin No. 596. Washington: Bureau of Education, 1914. Pp. 76.

Presents the results of first-hand observations made on selected trade schools in Great Britain, France, Germany, Austria, Belgium, Switzerland and Italy. Of particular value is the account of the relations between the apprentice system and the schools of the various countries.

KARL POMEROY HARRINGTON. *The Roman Elegiac Poets.* Cincinnati: American Book Co., 1914. Pp. 444.

A textbook for colleges, containing discriminating selections from the whole field of Roman elegy. There is an interesting introduction on the history of the elegy.

NATHAN A. HARVEY. *The Feelings of Man, Their Nature, Function and Interpretation.* Baltimore: Warwick & York, 1914. Pp. viii, 276. $1.60.

The author's statement that in spite of the great activity in experimental psychology during the past twenty-five years little advance has been made in the study of the feelings would probably meet with the assent of most psychologists, but it is doubtful whether that is sufficient justification for ignoring in a book of this type practically everything that has been said or done on the subject in that time. The book is frankly devoted to the development of a theory of the feelings, and perhaps on this account the author considers himself absolved from any extended reference to experimentally-determined facts. The James-Lange theory is examined at some length and rejected as inadequate, and the essence of the author's theory is that "feeling is the concomitant of the resistance which a nervous impulse encounters in passing through a nervous arc." The book is written in a popular rather than a scientific style, although there is frequent reference to nerve anatomy and physiology. In the chapter on the relation of feeling to attention it is somewhat surprising to find no reference to Titchener's masterful discussion of the subject.

W. T. HODGES. *Important Features in Rural School Improvement.* Bulletin No. 599. Washington: Bureau of Education, 1914. Pp. 55.

In pursuance of the plan to make the Bureau of Education a clearing-house for all matters of educational interest and improvement, 3500 letters were sent to township, county and district superintendents asking for a report on anything of unusual or special value that had occurred in connection with rural schools in their locality, or any methods that had resulted in improving the efficiency of rural school service. The present monograph was compiled from the replies, and constitutes a report on the vanguard of rural school improvement.

GEORGE W. HUNTER. *A Civic Biology, Presented in Problems.* Cincinnati: American Book Co., 1914. Pp. 432.

A very interesting attempt to secure keen motivation for the study of biology by high-school pupils. There is an increasing demand on the high school to furnish its pupils with an adequate knowledge of fundamental life processes. From the cultural point of view this is of much greater importance than drill in languages and mathematics. The day will soon come when biology will be a subject required of all high-school pupils, and textbooks like the one under consideration will be of great assistance to both teachers and pupils in stimulating interest and in leading on to a more extended study of biology. An attractive feature of the book is the abundance of illustrations.

ROBERT A. KASPER. *Some People Marry.* Boston: Richard G. Badger, 1914. Pp. 122. $1.00.

An indifferent play which turns upon the social status of one whose birth was illegitimate, but was later legitimatized by marriage.

GEORGE TRUMBULL LADD. *What Can I Know? An Inquiry Into Truth, its Nature, the Means of its Attainment and its Relations to Practical Life.* New York: Longmans, Green & Co., 1914. Pp. vii, 311. $1.50 net.

A laudable and successful attempt to discuss the problem of knowledge in terms which will be familiar to the ordinary educated man. In most entertaining fashion the author pays his respects to Rationalism, Empiricism, Pragmatism, Absolutism, Realism and other schools of epistemological thinking, and in the end prides himself on the fact that the reader has been unable to identify him with any of them.

CYRUS D. MEAD. *Height and Weight of Children in Relation to General Intelligence.* Reprinted from Pedagogical Seminary, Vol. 21, No. 3, September, 1914. 394-406.

A study of 429 feeble-minded children leads to the conclusion that mental defectives are also physically retarded, and that the more decided the mental defect, the greater the physical retardation.

WILLIAM J. MILNE. *Standard Algebra, Revised.* Cincinnati: The American Book Co., 1914. Pp. 496.

A substantial, representative text for secondary algebra. Considerable attention is paid to graphic solutions of both simple and quadratic equations.

PAUL MONROE, Editor. *Principles of Secondary Education.* New York: The Macmillan Company, 1914. Pp. xxviii, 790. $1.90 net.

An encyclopedic handbook of high-school organization, management and instruction. The discussions of the various phases of high-school work have been written by thirty-one contributors, each a specialist, and in many cases the foremost authority in the field which he considers. It is, therefore, probably the most complete and reliable pronouncement upon high-school matters to be found between the covers of a single book. The first two chapters, by the editor, deal with the meaning, scope and historical development of secondary education; chapters three and four compare European systems of secondary education with the high-school systems of the United States; chapters five and six discuss the organization of the high school; chapter seven treats of the psychology and hygiene of adolescence; chapter eight of moral education; chapters nine to sixteen consider the specific subjects of instruction, including English, the classics, modern languages, the natural sciences, mathematics, history, civics, the fine and household arts; and the remaining five chapters take up such topics as vocational education, hygiene and physical education, athletics, social aspects of high-school education and the reorganization of secondary education. It will be seen, therefore, that the book is of value both for the administrator and the teacher, and will probably dispute with Johnston's volumes on high-school administration and organization the rank of standard treatise on the subject.

MARGARETHE MUELLER. *Elsbeth, a Story of German Home Life.* New York: E. P. Dutton & Co., 1914. Pp. xxi, 296. $1.25.

This charming story in the "Little Schoolmate Series" will give children an excellent idea of some of the German customs and family relationships which lend to their home life its delightful inti-

macy and *"Gemüthlichkeit."* An attractive feature of the book is the number of German songs, which are translated in the appendix and set to music, so that they may be sung by the readers.

ERASTUS PALMER AND L. WALTER SAMMIS. *The Principles of Oral English.* New York: The Macmillan Company, 1914. Pp. xii, 222. 60 cents.

This is not a book on oral English composition, but deals rather with the first principles of elocution, with especial reference to oratory. There are chapters on breathing, articulation, modulation, vocal inflection and emphasis, with a considerable number of selections for practice.

G. T. W. PATRICK. *The Psychology of Play.* Reprinted from Pedagogical Seminary, Vol. 21, No. 3, September, 1914. 469-484.

Reviews the various theories of play, and shows that children's plays and adult sports both have their roots far back in the cultural history of the race. Pleads for a greater recognition of the need for play in modern life.

KARL PEARSON. *The Life, Letters and Labors of Francis Galton.* Volume I. Cambridge: University Press. New York: G. P. Putnam's Sons, 1914. Pp. xxiii, 246. $6.25.

The two outstanding figures in the English biological world of last century were Charles Darwin and Francis Galton, and, while Darwin has undoubtedly had the greater influence on scientific thought in the past, there are those who believe that Galton's influence will be more significant for the future. Of the two cousins Galton, by his interest in anthropometry, biometry and genetics, has certainly contributed more to foster scientific studies in education, and in a sense he must be looked upon as the patron saint of educational measurement. Educationists, therefore, will be especially interested in this monumental biography from the pen of the Director of the Galton Eugenics Laboratory. A large part of the first volume is naturally devoted to tracing the ancestry of Francis Galton, and pointing out the origin of those traits which characterize his later scientific activities. Probably in no biography extant are the hereditary factors so carefully and completely worked out, and, as many of these on the maternal side are common to the two cousins, the book forms an interesting contribution to the life of Charles Darwin as well. The account of Galton's early life, his school days, his experiences as a sort of apprentice in the Birmingham hospital, his student life at Cambridge, and his explorations in South Africa are admirably portrayed, and the account is illuminated by liberal quotations from his letters. It is a book that should be found in every educational library.

LAURA SPENCER PORTOR. *Genevieve, a Story of French School Days.* New York: E. P. Dutton & Co., 1914. Pp. xxv, 327. $1.25.

This number of the "Little Schoolmate Series" gives an entertaining account of boy and girl life in France. There are rambles about Paris, a trip to Marseilles, and much about Joan of Arc and other characters in French history.

Proceedings of a Conference on Educational Measurements. Indiana University Bulletin, Vol. XII, September, 1914. Pp. 170. 50 cents.

This conference was held at Indiana University, April 17 and 18, 1914. The bulletin reports in detail both the formal papers and the discussions which ensued. Among the topics presented we note: "Means of increasing efficiency in arithmetic," "Giving of tests in reading," "Individual differences and their causes" and "Units and scales for measuring educational products," all by Professor E. L. Thorndike; "Results of Binet tests," by Professor E. E. Jones; "Organization of school surveys," by Superintendent H. L. Smith; "Use of Courtis tests," by Mary Kerr; "Elementary teachers and cooperative research," by Professor M. E. Haggerty, and a round table, led by Dr. W. F. Book, on "What the University can do for the elementary and secondary schools of Indiana." The bulletin contains a good deal of valuable material; that dealing with recently-developed plans for testing reading ought especially to prove timely to many of our readers.

W. H. PYLE. *Abnormal and Defective Children.* Columbia, Mo.: University of Missouri Bulletin, Vol. XV, No. 28, October, 1914. Pp. 10.

A bulletin on the care and training of abnormal and defective children for the benefit of those who come in contact with such children in the schools, and who are interested in the formation of special classes for them. There is a paragraph on the treatment of supernormal children.

CASPER L. REDFIELD. *Dynamic Evolution. A Study of the Causes of Evolution and Degeneracy.* New York: G. P. Putnam's Sons, 1914. Pp. xi, 210. $1.50 net.

"This book deals with those characteristics which make one animal superior to another in the struggle for existence. The writer formulates a theory of animal energy, the process by which it is increased or diminished from generation to generation, and the manner in which it is transmitted. This theory he substantiates by statistics drawn from the pedigrees of horses, cattle, dogs and men."

Report of the Commission on National Aid to Vocational Education. Volume I. Washington: Government Printing Office, 1914. Pp. 207.

This important document presents the detailed reports on the basis of which the recently-enacted Smith-Lever law was formulated.

BERTRAND RUSSELL. *Our Knowledge of the External World as a Field for Scientific Method in Philosophy.* Chicago: The Open Court Publishing Co., 1914. Pp. vii, 245. $2.00.

The author, who is well known for his contributions to mathematical logic, endeavors to indicate the principles upon which philosophy may become scientific instead of remaining in the sphere of the mystically imaginative, as do the philosophical systems of the past. After a survey of current philosophical tendencies and a discussion of logic as the essence of philosophy, the author devotes himself to an analysis of our knowledge of the external world, points out the difference between the world of sense and the world of physics, and shows that the whole conception of the world of physics is a construction rather than an inference. There are further chapters on the theory of continuity, the problems of infinity and the notion of cause.

LEVI SEELY. *History of Education.* Revised Edition. Cincinnati: The American Book Co., 1914. Pp. 349.

This book is "designed to furnish all the material that can be reasonably demanded for any state, county or city teacher's certificate"; but, while it may accomplish this purpose fairly well, the treatment of the subject is so sketchy that students can scarcely obtain a fair idea of educational development.

JOSEPH S. TAYLOR, Editor. *Reply of the Association of District Superintendents of New York to Certain Findings and Recommendations of Professor Frank M. McMurry and Professor Edward C. Elliott.* New York: Published by a Committee of the Association, 1914. Pp. 116. 50 cents.

If the Hanus School Inquiry Commission has had no other effect, it has at least stimulated the teaching force of New York city to analyze the conditions of their service, and to give some justification to themselves and to others for their existence. Perhaps the fostering of the critical attitude toward one's work is the most valuable outcome of any investigation.

WINIFRED LOUISE TAYLOR. *The Man Behind the Bars.* New York: Charles Scribner's Sons, 1914. Pp. viii, 302. $1.50 net.

A simple and touching narrative of experiences with convicts ranging over a period of twenty-five years. One cannot read this book and suppress a shudder at the crimes against human nature that are committed in the name of justice. The author says: "I have no wish to see our prisons abolished; but thousands of individuals and millions of dollars have been sacrificed to wrong methods of punishment; and if we aim to reform our criminals we must first reform our methods of dealing with them, from the police court to the penitentiary." Happily, there are signs that the public is beginning to realize that it is not only humanitarian, but economical, to emphasize the educational rather than the punitive treatment of criminals.

CORNELIA CARHART WARD. *Oral Composition.* New York: The Macmillan Company, 1914. Pp. xii, 412. $1.00.

An attempt to set forth the essentials of oral composition in the high school, and to present an outline that will be helpful to both teachers and pupils. The book is in three parts: Part I deals with the conditions of good speaking, including preparation of material, paragraph and sentence formation, and the use of the voice in speaking; part II, with the four traditional types of writing and speaking, narration, description, exposition and argumentation, and part III with topics and illustrative material.

JOHN B. WATSON. *Behavior: An Introduction to Comparative Psychology.* New York: Henry Holt & Co., 1914. Pp. xii, 439.

Not only comparative psychologists, but psychologists of all descriptions, will be interested in this systematic exposition of the principles of behaviorism by its best known advocate. No more strikingly radical psychological treatise has appeared in years, and it is probable that the positions taken will be storm centers or platforms for reform campaigns for some time to come. At the outset the author charges that human psychology has failed to make good its claim as a natural science, that by its insistence upon the method of introspection it has introduced a mystical and uncontrollable element that precludes a strictly scientific procedure. "Psychology, as the behaviorist views it, is a purely objective, experimental branch of natural science which needs introspection as little as do the sciences of chemistry and physics." Human behavior should be treated on precisely the same plane and studied under the same conditions and by the same methods as animal behavior. This does not exclude the consideration of language as a type of response, for human responses have become so abbreviated and so highly symbolic that the linguistic element constitutes one of the chief factors in

behavior. The problems of both human and animal behavior are classified under four heads: (1) Sense organ functions. (2) Instinctive functions. (3) Habit formation. (4) Correlation: (a) among behavior data; (b) of behavior with structure, and (c) of behavior and structure with physico-chemical processes. There follow acutely reasoned discussions of instincts and habit formation, the abridgment of the learning process, the limits of training in animals, language habits as the characteristic differentiation of man from brute, and a detailed examination of the results of experiments in various sense fields. It is a stimulating and thought provoking book.

H. H. Webster and Fannie E. Coe. *Tales and Verse from Sir Walter Scott.* Cincinnati: The American Book Co., 1914. Pp. 384.

Several extracts from accounts of Scott, his friends and his career, are followed by selections from his poems and novels, making a very attractive supplementary reader.

Webster's Elementary School Dictionary. Cincinnati: The American Book Co., 1914. Pp. xvi, 702.

This school dictionary is abridged from Webster's New International Dictionary, contains 45,000 entries and is richly illustrated. The terms are especially selected with reference to the best modern elementary school practice.

Eva Wilkins. *The Weaver's Children.* Cincinnati: The American Book Co., 1914. Pp. 208.

An interesting story of the home life, travels and experiences of a weaver's family in the second quarter of last century. Children from eight to ten will find it fascinating, and will learn from it a great deal about the life of that time.

W. H. Winch. *Children's Perceptions. An Experimental Study of Observation and Report in School Children.* Educational Psychology Monographs, No. 12. Baltimore: Warwick & York, Inc., 1914. Pp. x, 245. $1.50.

The training of the senses, the cultivation of the powers of observation, are phrases which are frequently heard nowadays not only from laymen, but from professional educators from Montessori to college presidents. But in the minds of the thoughtful this enthusiasm for sense-training raises the query, "To what extent and by what methods can observation be trained?" And this leads to the further reflection that only a beginning has yet been made in the effort to measure the child's powers of observation and thus obtain

a basis to attack the problem of training. It is to Professor Stern of Breslau that the credit is due of first attempting to study scientifically the observations of individuals, and Mr. Winch has not only employed the same methods, but some of the same material in his study of the observations of English school children. Eight series of experiments were conducted in different schools with boys and girls of different ages and grades, and the results are tabulated in detail with reference to the perception of clothes, position, activities, things, number, color, and to the development of the perceptual attitude. The monograph is a painstaking study of the conditions which lie at the very basis of children's observations, and constitutes a valuable contribution to educational psychology.

FLORENCE HULL WINTERBURN. *The Mother in Education.* New York: McBride, Nast & Co., 1914. Pp. xiv, 337. $1.50 net.

The author firmly believes that well begun is half done in education, and that with the proper home training school education can be shortened by several years. Hence the responsibility that rests upon the mother for the early education of her children. It is for the purpose of suggesting helps to the mother that this book was written, and there are interesting and ingenious suggestions for training in the use of the mother tongue, observation, nature studies, form, size, number, reading, drawing, foreign languages, travel and artistic appreciation. While making no pretensions to psychologic lore, the book is full of shrewd observations and helpful hints.

ROBERT M. YERKES AND DANIEL W. LARUE. *Outline of a Study of the Self.* Second revised edition. Cambridge, Mass.: Harvard University Press, 1914. Pp. 24.

The first edition of this outline was issued last year, and it is gratifying to note that a second edition has been brought out so soon. In their experience as teachers of psychology the authors have found it a valuable exercise for students to make as complete and detailed an analysis of their own personalities as possible, and it was to facilitate this analysis that the outline was prepared. The self is to be studied from four points of view: (1) As a product of heredity, for which purpose use is made of the "Record of Family Traits," issued by the Eugenics Record Office. (2) As a developing, reacting mechanism, taking account of the conditions of prenatal life, and the self in infancy, in childhood and adolescence. (3) As a self-conscious willing being, including both physical equipment and mental characteristics. (4) As a member of social groups, involving vocational, marital and social relationships. The record calls for such a complete and searching confessional that many people would feel hesitancy about filling it out, even though it is to be kept strictly confidential.